STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

Request For Bids For Construction Services
Two-Stage Bidding Process

Stage II – General Contractors Bidders List
Invitation to Bid

April 4, 2006

IRRIGATION, LANDSCAPING AND CONCRETE UPGRADES PETERSON PLAZA

WEBER STATE UNIVERSITY

OGDEN, UTAH

DFCM Project No. 05070810

Bingham Engineering

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Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at http://dfcm.utah.gov or are available upon request from DFCM:

DFCM General Conditions dated May 25, 2005
DFCM Application and Certificate for Payment dated May 25, 2005

Technical Specifications:
Drawings:

The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at http://dfcm.utah.gov

INVITATION TO BID

ONLY CONTRACTORS PREVIOUSLY SHORT-LISTED DURING STAGE I ARE ALLOWED TO BID ON THIS PROJECT

The State of Utah - Division of Facilities Construction and Management (DFCM) is requesting bids for the construction of the following project:

IRRIGATION, LANDSCAPING AND CONCRETE UPGRADES - PETERSON PLAZA
WEBER STATE UNIVERSITY - OGDEN, UTAH
DFCM PROJECT NO: 05070810

Project Description: This project includes site improvements and upgrades to the plaza walkways, patios, irrigation, landscaping and block wall. Construction Cost Estimate: $385,000.00

FIRM NAME	POINT OF CONTACT	PHONE	FAX
ABCO Construction, Inc.	Mr. Reed Price	(435) 723-3770	(435) 723-3311
Ascent Construction	Mr. Dan Wall	(801) 299-1711	(801) 299-0663
Bellock Construction, Inc	Ms. Melody Bellock	(801) 277-7805	(801) 277-5751
Broderick and Henderson Const	Mr. Gary Broderick	(801) 225-9213	(801) 225-4697
Cal Wadsworth Construction	Mr. Cal Wadsworth	(801) 208-1957	(801) 208-1975
Chad Husband Construction, Inc	Mr. Richard Marshall	(801) 972-1146	(801) 886-1784
Comtrol Inc.	Mr. Ralph B. Burk	(801) 561-2263	(801) 561-2305
Darrell Anderson Construction	Mr. James Anderson	(435) 752-6860	(435) 752-7606
Garff Construction	Mr. Phil Henriksen	(801) 973-4248	(801) 972-1928
Gramoll Construction	Mr. Ken Romney	(801) 295-2341	(801) 295-2356
Jepson Construction	Mr. Rick Jepson	(801) 774-8860	(801) 773-8980
Keller Construction	Mr. S. Daniel Hill	(801) 972-1018	(801) 972-1063
McCullough Engineering	Mr. Jim McCullough	(801) 466-4949	(801) 466-4989
Saunders Construction	Mr. Edward Saunders	(801) 782-7830	(801) 782-7856
Spectrum Construction of Utah	Mr. Ronald Snowden	(801) 915-6222	(801) 607-2203
Valley Design and Construction	Mr. Corey King	(801) 927-9542	(801) 927-9544
Wade Payne Construction, Inc.	Mr. Wade Payne	(801) 226-6144	(801) 226-7772

The bid documents will be available at 10:00 AM on Tuesday, April 4, 2006 in electronic format from DFCM at 4110 State Office Building, Salt Lake City, Utah 84114, telephone (801)538-3018 and on the DFCM web page at http://dfcm.utah.gov. For questions regarding this project, please contact Bob Anderson, Project Manager, DFCM, at (801)-652-6754. No others are to be contacted regarding this project.

A **MANDATORY** pre-bid meeting and site visit will be held at 2:00 PM on Friday April 7, 2006 at Weber State University, Peterson Plaza, north side of Building #4. All short listed prime contractors wishing to bid on this project must attend this meeting.

Bids must be submitted by 3:00 PM on Tuesday, April 18, 2006 to DFCM, 4110 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. Note: Bids must be received at 4110 State Office Building by the specified time. The contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah. A bid bond in the amount of five percent (5%) of the bid amount, made payable to the Division of Facilities Construction and Management on DFCM's bid bond form, shall accompany the bid. The Division of Facilities Construction & Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of the State.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
MARLA WORKMAN, CONTRACT COORDINATOR
4110 State Office Bldg., Salt Lake City, Utah 84114

STAGE II BIDDING PROCESS

ONLY CONTRACTORS PREVIOUSLY SHORT-LISTED DURING STAGE I ARE ALLOWED TO BID ON THIS PROJECT

1. Invitational Bid Procedures

Invitation to Bid: DFCM will notify each short-listed firm via e-mail and/or fax when a project is ready for construction services.

Bid Documents: Bidding documents including plans and specifications (if applicable) may be obtained by accessing DFCM's web page at http://dfcm.utah.gov or at DFCM's office 4110 State Office Building, Salt Lake City, Utah 84114.

Mandatory Pre-Bid Site Meeting: If required, the schedule contained in this document will indicate the date, time, and place of the mandatory pre-bid site meeting. At this meeting, contractors will receive additional instructions about the project and have an opportunity to ask questions about project details. If a firm fails to attend a pre-bid site meeting labeled "Mandatory" they will not be allowed to bid on the project.

Written Questions: The schedule contained in this document will indicate the deadline for submitting questions in writing to the DFCM Representative pertaining to this project.

Final Addendum: The schedule contained in this document will indicate the deadline for DFCM issuing the final addendum clarifying questions and changes to the scope of work. Contractors are responsible for obtaining and responding to information contained in the addenda.

Submitting Bids: Bids must be submitted to DFCM, 4110 State Office Building, Salt Lake City, Utah 84114 by the deadline indicated on the schedule contained in this document. Bids submitted after the deadline will not be accepted. Bids will be opened at DFCM on the date, time, and place indicated on the schedule. (Additional information pertaining to bidding is contained later in this document). It is your responsibility to allow for the time needed to park on Capitol Hill as recent construction activity has made the parking more difficult. Identification is required to enter the building.

Subcontractors List: The firm selected for the project must submit a list of all subcontractors by the deadline indicated on the schedule contained in this document. (Additional information pertaining to subcontractor lists is contained later in this document)

2. Drawings and Specifications, Other Contract Documents

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Notice to Contractors.

3. **Bids**

Before submitting a bid, each bidder shall carefully examine the Contract Documents; shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Representative and the necessary changes shall be accomplished by Addendum.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Notice to Contractor's prior to the published deadline for the submission of bids.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.

If the bid bond security is submitted on a bid bond form other than the DFCM's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. **Note: A cashier's check cannot be used as a substitute for a bid bond.**

4. **Contract and Bond**

The Contractor's Agreement will be in the form bound in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the Contract Sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for Subcontractors will be specified in the Supplementary General Conditions.

5. Listing of Subcontractors

Listing of Subcontractors shall be as summarized in the "Instructions and Subcontractor's List Form", which are included as part of these Contract Documents. The subcontractors list shall be delivered to DFCM or faxed to DFCM at (801)538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the Contract Documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contract for a period of up to three years.

6. Interpretation of Drawings and Specifications

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Representative a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by Addenda duly issued and a copy of such Addenda will be mailed or delivered to each person or entity receiving a set of documents. Neither DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

7. Addenda

Any Addenda issued during the time of bidding shall become part of the Contract Documents made available to the bidders for the preparation of the bid, shall be covered in the bid, and shall be made a part of the Contract.

8. Award of Contract

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of the State of Utah to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. The DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.

9. **DFCM Contractor Performance Rating**

DFCM will evaluate the performance of the Contractor. This evaluation may include comments from the User. The Contractor will have an opportunity to review and comment on the evaluation. Evaluations, including the Contractor's comments, may be considered in future selection in the evaluation of the Contractor's past performance.

10. **Licensure**

The Contractor shall comply with and require all of its Subcontractors to comply with the license laws as required by the State of Utah.

11. **Right to Reject Bids**

DFCM reserves the right to reject any or all Bids.

12. **Time is of the Essence**

The completion deadline for this project is **August 18, 2006.** Failure to meet the completion deadline may result in a poor performance rating from DFCM which may have a negative impact on your firm's ability to obtain future work with the state of Utah and may also result in liquidated damages being assessed. Time is of the essence in regard to all the requirements of the Contract Documents.

13. **Withdrawal of Bids**

Bids may be withdrawn on written request received from bidders within 24 hours after the bid opening if the contractor has made an error in preparing the bid.

14. **Product Approvals**

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed

the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued Addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

15. **Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors**

Contractors shall respond promptly to any inquiry in writing by the DFCM to any concern of financial responsibility of the Contractor, Subcontractor or Sub-subcontractor.

16. **Debarment**.

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by the DFCM as part of the requirements for award of the Project.

PROJECT SCHEDULE
Stage II = Two-Stage Bidding Process

PROJECT NAME: **IRRIGATION, LANDSCAPING & CONCRETE UPGRADES - PETERSON PLAZA WEBER STATE UNIVERSITY – OGDEN, UTAH**

DFCM PROJECT #: **05070810**

Event	Day	Date	Time	Place
Stage II Bidding Documents Available	Tuesday	April 4, 2006	10:00 AM	DFCM 4110 State Office Bldg SLC, UT and DFCM web site *
Mandatory Pre-bid Site Meeting	Friday	April 7, 2006	2:00 PM	North Side of Building #4. Peterson Plaza Weber State University Ogden, UT
Last Day to Submit Questions	Wednesday	April 12, 2006	4:00 PM	DFCM 4110 State Office Bldg SLC, UT
Final Addendum Issued	Friday	April 14, 2006	4:00 PM	DFCM 4110 State Office Bldg SLC, UT or DFCM web site*
Prime Contractors Turn in Bid and Bid Bond / Bid Opening in DFCM Conference Room	Tuesday	April 18, 2006	3:00 PM	DFCM 4110 State Office Bldg SLC, UT
Subcontractors List Due	Wednesday	April 19, 2006	3:00 PM	DFCM 4110 State Office Bldg SLC, UT
Project Completion Date	Friday	August 18, 2006	4:00 PM	

*** DFCM's web site address is http://dfcm.utah.gov**

BID FORM

NAME OF BIDDER _____ DATE _____

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the Request for Bids for the **IRRIGATION, LANDSCAPING AND CONCRETE UPGRADES - PETERSON PLAZA - WEBER STATE UNIVERSITY – OGDEN, UTAH - DFCM PROJECT NO. 05070810** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

_____ DOLLARS ($_____)
(In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by **August 18, 2006** after receipt of the Notice to Proceed, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **$500.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of _____

The undersigned Contractor's License Number for Utah is _____.

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract. The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable l00% Performance and Payment bonds are not delivered within time set forth.

Type of Organization: _____
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

_____

Respectfully submitted,

_____
Name of Bidder

ADDRESS:

_____

_____

_____
Authorized Signature

BID BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed, (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the STATE OF UTAH, hereinafter referred to as the "Obligee," in the amount of $_____ (5% of the accompanying bid), being the sum of this Bond to which payment the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal has submitted to Obligee the accompanying bid incorporated by reference herein, dated as shown, to enter into a contract in writing for the _____ _____ Project.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that if the said principal does not execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the principal, then the sum of the amount stated above will be forfeited to the State of Utah as liquidated damages and not as a penalty; if the said principal shall execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the Principal, then this obligation shall be null and void. It is expressly understood and agreed that the liability of the Surety for any and all defaults of the Principal hereunder shall be the full penal sum of this Bond. The Surety, for value received, hereby stipulates and agrees that obligations of the Surety under this Bond shall be for a term of sixty (60) days from actual date of the bid opening.

PROVIDED, HOWEVER, that this Bond is executed pursuant to provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their several seals on the date indicated below, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

DATED this _____ day of _____, 20_____ .

Principal's name and address (if other than a corporation):

_____

_____

By: _____

Title: _____

Principal's name and address (if a corporation):

_____

_____

By: _____

Title: _____

(Affix Corporate Seal)

Surety's name and address:

_____

_____

By: _____

Attorney-in-Fact (Affix Corporate Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this ____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.
My Commission Expires: _____
Resides at: _____

_____
NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

INSTRUCTION AND SUBCONTRACTORS LIST FORM

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, on the following basis:

PROJECTS UNDER $500,000 - ALL SUBS $20,000 OR OVER MUST BE LISTED
PROJECTS $500,000 OR MORE - ALL SUBS $35,000 OR OVER MUST BE LISTED

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- Bidder must list "Self" if performing work itself.

LICENSURE:

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

BIDDER LISTING 'SELF' AS PERFORMING THE WORK:

Any bidder that is properly licensed for the particular work and intends to perform that work itself in lieu of a subcontractor that would otherwise be required to be on the subcontractor list, must insert the term 'Self' for that category on the subcontractor list form. Any listing of 'Self' on the sublist form shall also include the amount allocated for that work.

'SPECIAL EXCEPTION':

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A.Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

GROUNDS FOR DISQUALIFICATION:

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

(1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
(2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
(3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
(4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
(5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
(6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

EXAMPLE:

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #
ELECTRICAL	ABCD Electric Inc.	$350,000.00	123456789000
LANDSCAPING	"Self"	300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: 350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS SUBCNTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.

SUBCONTRACTORS LIST
FAX TO 801-538-3677

PROJECT TITLE: _____

Caution: You must read and comply fully with instructions.

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #

We certify that:
1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed "Self" or "Special Exception" in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: _____

DATE: _____ SIGNED BY: _____

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR DFCMS REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY DFCM. ATTACH A SECOND PAGE IF NECESSARY.

FUGITIVE DUST PLAN

The Contractor will fill out the form and file the original with the Division of Air Quality and a copy of the form with the Division of Facilities Construction & Management, prior to the issuance of any notice to proceed.

The Contractor will be fully responsible for compliance with the Fugitive Dust Control Plan, including the adequacy of the plan, any damages, fines, liability, and penalty or other action that results from noncompliance.

Utah Division of Air Quality
April 20, 1999

GUIDANCE THAT MUST BE CONSIDERED IN DEVELOPING AND SUBMITTING A DUST CONTROL PLAN FOR COMPLIANCE WITH R307-309-3, 4, 5, 6, 7

Source Information:

1. Name of your operation (source): provide a name if the source is a construction site.

2. Address or location of your operation or construction site.

3. UTM coordinates or Longitude/Latitude of stationary emission points at your operation.

4. Lengths of the project, if temporary (time period).

5. Description of process (include all sources of dust and fugitive dust). Please, if necessary, use additional sheets of paper for this description. Be sure to mark it as an attachment.

6. Type of material processed or disturbed.

7. Amount of material processed (tons per year, tons per month, lbs./hr., and applicable units).

8. Destination of product (where will the material produced be used or transported, be specific, provide address or specific location), information needed for temporary relocation applicants.

9. Identify the individual who is responsible for the implementation and maintenance of fugitive dust control measures. List name(s), position(s) and telephone number(s).

10. List, and attach copies of any contract lease, liability agreement with other companies that may, or will, be responsible for dust control on site or on the project.

Description of Fugitive Dust Emission Activities
(Things to consider in addressing fugitive dust control strategies.)

1. Type of activities (drilling and blasting, road construction, development construction, earth moving and excavation, handling and hauling materials, cleaning and leveling, etc).

2. List type of equipment generating the fugitive dust.

3. Diagram the location of each activity or piece of equipment on site. Please attach the diagram.

4. Provide pictures or drawings of each activity. Include a drawing of the unpaved/paved road network used to move loads "on" and "off" property.

5. Vehicle miles travels on unpaved roads associated with the activity (average speed).

6. Type of dust emitted at each source (coal, cement, sand, soil, clay, dust, etc.)

7. Estimate the size of the release area at which the activity occurs (square miles). For haul or dirt roads include total miles of road in use during the activity.

Description of Fugitive Dust Emission Controls on Site

Control strategies must be designed to meet 20% opacity or less on site (a lesser opacity may be defined by Approval Order conditions or federal requirements such as NSPS), and control strategies must prevent exceeding 10% opacity from fugitive dust at the property boundary (site boundary) for compliance with R307-309-3.

1. Types of ongoing emission controls proposed for each activity, each piece of equipment, and haul roads.

2. Types of additional dust controls proposed for bare, exposed surfaces (chemical stabilization, synthetic cover, wind breaks, vegetative cover, etc).

3. Method of application of dust suppressant.

4. Frequency of application of dust suppressant.

5. Explain what triggers the use of a special control measure other than routine measures already in place, such as covered loads or measures covered by a permit condition (increase in opacity, high winds, citizen complaints, dry conditions, etc).

6. Explain in detail what control strategies/measures will be implemented off-hours, i.e., Saturdays/Sundays/Holidays, as well as 6 PM to 6 AM each day.

Description of Fugitive Dust Control Off-site

Prevent, to the maximum extent possible, deposition of materials, which may create fugitive dust on public and private paved roads in compliance with R307-309-5, 6, 7.

1. Types of emission controls initiated by your operation that are in place "off" property (application of water, covered loads, sweeping roads, vehicle cleaning, etc.).

2. Proposed remedial controls that will be initiated promptly if materials, which may create fugitive dust, are deposited on public and private paved roads.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Fugitive Dust Control Plan Violation Report

When a source is found in violation of R307-309-3 or in violation of the Fugitive Dust Control Plan, the course must submit a report to the Executive Secretary within 15 days after receiving a Notice of Violation. The report must include the following information:

1. Name and address of dust source.

2. Time and duration of dust episode.

3. Meteorological conditions during the dust episode.

4. Total number and type of fugitive dust activities and dust producing equipment within each operation boundary. If no change has occurred from the existing dust control plan, the source should state that the activity/equipment is the same.

5. Fugitive dust activities or dust producing equipment that caused a violation of R-307-309-3 or the sources dust control plan.

6. Reasons for failing to control dust from the dust generating activity or equipment.

7. New and/or additional fugitive dust control strategies necessary to achieve compliance with R307-309-3, 4, 5, 6, or 7.

8. If it can not be demonstrated that the current approved Dust Control Plan can result in compliance with R307-309-3 through 7, the Dust Control Plan must be revised so as to demonstrate compliance with 307-309-3 through 7. Within 30 days of receiving a fugitive dust Notice of Violation, the source must submit the revised Plan to the Executive Secretary for review and approval.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Attachments: DFCM Form FDR R-307-309, Rule 307-309

CONTRACTOR'S AGREEMENT

FOR:

_____
_____
_____

THIS CONTRACTOR'S AGREEMENT, made and entered into this ____ day of _____, 20__, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and _____, incorporated in the State of _____ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is _____.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at _____ _____.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

ARTICLE 1. SCOPE OF WORK. The Work to be performed shall be in accordance with the Contract Documents prepared by _____ and entitled "_____."

The DFCM General Conditions ("General Conditions") dated May 25, 2005 on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

ARTICLE 2. CONTRACT SUM. The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of _____ _____ DOLLARS AND NO CENTS ($_____.00), which is the base bid, and which sum also includes the cost of a 100%

Performance Bond and a 100% Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY. The Work shall be Substantially Complete within _____ (___) calendar days after the date of the Notice to Proceed. Contractor agrees to pay liquidated damages in the amount of $_____ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

ARTICLE 4. CONTRACT DOCUMENTS. The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Notice to Contractors, Instructions to Bidders/Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

ARTICLE 5. PAYMENT. The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the

Contractor requests payment and agrees to safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

ARTICLE 6. INDEBTEDNESS. Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

ARTICLE 7. ADDITIONAL WORK. It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

ARTICLE 8. INSPECTIONS. The Work shall be inspected for acceptance in accordance with the General Conditions.

ARTICLE 9. DISPUTES. Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT. This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF. The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

ARTICLE 12. INDEMNIFICATION. The Contractor shall comply with the indemnification provisions of the General Conditions.

ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT. The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

ARTICLE 14. RELATIONSHIP OF THE PARTIES. The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT. Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

ARTICLE 16. ATTORNEY FEES AND COSTS. Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

IN WITNESS WHEREOF, the parties hereto have executed this Contractor's Agreement on the day and year stated hereinabove.

CONTRACTOR: _____

_____
Signature Date

Title: _____

State of _____)
)
County of _____) _____
Please type/print name clearly

On this ____ day of _____, 20____, personally appeared before me, _____, whose identity is personally known to me (or proved to me on the basis of satisfactory evidence) and who by me duly sworn (or affirmed), did say that he (she) is the _____ (title or office) of the firm and that said document was signed by him (her) in behalf of said firm.

_____
Notary Public

(SEAL)

My Commission Expires _____

APPROVED AS TO AVAILABILITY OF FUNDS:

_____
Financial Manager, Date
Division of Facilities Construction and Management

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

_____
_____ Date
Manager -
Capital _____

APPROVED AS TO FORM:
ATTORNEY GENERAL
May 25, 2005
By: Alan S. Bachman
Asst Attorney General

APPROVED FOR EXPENDITURE:

_____
Division of Finance Date

PERFORMANCE BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That _____ hereinafter referred to as the "Principal" and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee, " in the amount of _____ _____ DOLLARS ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____, for the approximate sum of _____ _____ Dollars ($_____), which Contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20_____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____

(Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____

Attorney-in-Fact (Seal)

STATE OF _____)

) ss.

COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My commission expires: _____

Resides at: _____

_____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

PAYMENT BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____ _____, a corporation organized and existing under the laws of the State of _____authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of _____, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of _____ Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____ for the approximate sum of _____ _____ Dollars ($_____), which contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, l953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____

(Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____

Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____ _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.

My commission expires: _____

Resides at: _____

_____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

CHANGE ORDER #_____

CONTRACTOR:

ARCHITECT:

AGENCY OR INSTITUTION:
PROJECT NAME:
PROJECT NUMBER:
CONTRACT NUMBER:
DATE:

CONSTRUCTION CHANGE DIRECTIVE NO.	PROPOSAL REQUEST NO.	AMOUNT		DAYS	
		INCREASE	DECREASE	INCREASE	DECREASE

	Amount	Days	Date
ORIGINAL CONTRACT			
TOTAL PREVIOUS CHANGE ORDERS			
TOTAL THIS CHANGE ORDER			
ADJUSTED CONTRACT			

DFCM and Contractor agree that the terms, contract sum, scope of the Work and time specified in this Change Order shall constitute the full accord and satisfaction, and complete adjustment to the Contract and includes all direct and indirect costs and effects related to, incidental to, and/or reasonably implied from such change in the contract terms, sum, scope of the Work and time.

Contractor:_____
Date

Architect/Engineer:_____
Date

Agency or Institution:_____
Date

DFCM: _____
Date

Funding Verification:_____
Date

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT _____ PROJECT NO: _____

AGENCY/INSTITUTION _____

AREA ACCEPTED _____

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM - (Owner) accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at _____ (time) on _____ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

_____

_____

The Owner acknowledges receipt of the following closeout and transition materials:

☐ Record Drawings ☐ O & M Manuals ☐ Warranty Documents ☐ Completion of Training Requirements

A list of items to be completed or corrected (Punch List) is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof. The amount of_____. (Twice the value of the punch list work) shall be retained to assure the completion of the punch list work.

The Contractor shall complete or correct the Work on the list of (Punch List) items appended hereto within _____ ____calendar days from the above date of issuance of this Certificate. If the list of items is not completed within the time allotted the Owner has the right to be compensated for the delays and/or complete the work with the help of independent contractor at the expense of the retained project funds. If the retained project funds are insufficient to cover the delay/completion damages, the Owner shall be promptly reimbursed for the balance of the funds needed to compensate the Owner.

_____ by: _____

CONTRACTOR (include name of firm) (Signature) DATE

_____ by: _____

A/E (include name of firm) (Signature) DATE

_____ by: _____

USING INSTITUTION OR AGENCY (Signature) DATE

_____ by: _____

DFCM (Owner) (Signature) DATE

4110 State Office Building, Salt Lake City, Utah 84114
telephone 801-538-3018 • facsimile 801-538-3267 • http://dfcm.utah.gov

cc: Parties Noted
DFCM, Director

SECTION 02316

EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES

This specification adds a new section to APWA Manual of Standard Specification. All other provisions of the specifications remain in full force and effect.

PART 1 GENERAL

1.1 WORK INCLUDED

A. Obtain excavation permits from state and local authorities.
B. Excavate for utility systems and process piping systems, including manholes, catch basins, valves, and other appurtenances to the points of connection with the building utility or structure piping five (5) feet outside of the building or structure.
C. Locate and protect existing utilities, structures, landscaping, and other existing features.
D. De-water excavations as required.
E. Support excavations as required.
F. Place and compact bedding, pipe zone, and backfill materials over pipes and appurtenances to rough grade elevation.
G. Stockpile and dispose of excavated material

1.2 QUALITY ASSURANCE

A. Provide soil testing during excavation and placement of fill and backfill materials in accordance with the requirements of the Contract Documents.
B. Perform soil testing during excavation and placement of fill, bedding, initial backfill, and backfill materials to show compliance with the requirements of the Contract Documents.

1.3 REFERENCES

A ASTM D 422: Particle Size Analysis of Soils.
B. ASTM D 424: Calculating the Plasticity Index.
C. ASTM D 698: Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, using 5.5-lb (2.49-kg) Rammer and 12-in (304.8 mm) Drop.
D. ASTM Dl 556: Density of Soil In Place by the Sand-Cone Method.
E. ASTM D1557: Moisture-Density Relations of Soils and Soil Aggregate Mixtures using 10- pound rammer and 18-inch drop. (Modified Proctor).
F. ASTM D1663: Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
G. ASTM D 2419: Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
H. ASTM D 2487: Classification of Soils for Engineering Purposes.
I. ASTM D 2901: Test Method for Cement Content of Freshly-Mixed Soil-Cement.
J. ASTM D 2922: Density of Soil and Soil Aggregate In Place by Nuclear Methods (Shallow Depth).
K. ASTM D 3017: Test Methods for Moisture Content.

L. ASTM D 4253: Test Methods for Maximum Index Density of Soils, using a Vibratory Table.
M. ASTM D 4254: Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.
N. Federal Occupational Safety and Health Administration, Federal Register, Volume 37, No. 243, Sub-part P, Section 1926-652.

1.5 **DEFINITIONS**

A. Suitable Material: Excavated material from the site or imported material from off-site meeting the requirements of structural fill or non-structural fill material.
B. Unsuitable Material: Excavated material from the site that does not meet the requirements of structural fill or non-structural fill. This material shall be removed from the site.
C. Structural Fill: Fill placed on prepared sub-grade in areas which will ultimately be subjected to structural loadings due to footing, floor slabs, pavements, etc.
D. Non-structural Fill: Fill place on prepared sub-grade outside of areas which will not ultimately be subjected to structural loadings due to footing, floor slabs, pavements, etc.
E. Borrow Material: Material imported from off-site but made available at an Owner owned designated site. It is anticipated that borrow material will meet the requirements for structural fill material. If the quantity of acceptable borrow material is not sufficient to complete the Work, the Contractor shall notify the Engineer in writing. The notification shall include an estimated quantity of material required to complete the Work and the Contractor's Geotechnical Engineer's explanation for non-complying material.

1.6 **SUBMITTALS**

Submit the following to the Engineer:

A. Certified sieve analysis of the following materials and samples of the materials when requested by the Engineer:
   1. bedding and initial backfill
   2. imported trench fill
   3. foundation material (if required)
B. One optimum moisture-maximum density curve for each type of soil encountered or incorporated into the Work.
C. Compaction testing results.
D. For record purposes only and not for review or approval, submit shop drawings and data showing the intended plan for de-watering operations. Include locations and capacities of de-watering wells, well points, pumps, sumps, collection, and discharge lines, standby units, water disposal methods, monitoring and settlement measuring equipment, and data collection and dissemination. Submit, together with a copy of the approved UPDES permit, as applicable, not less than 15 days prior to start of de-watering operations.

PART 2 PRODUCTS

2.1 **FOUNDATION MATERIAL**

Foundation material shall be granular well-graded material with a maximum aggregate size of 2 inches and not more than 5 percent passing the 200 sieve.

2.2 **BEDDING, PIPE ZONE, AND INITIAL BACKFILL MATERIAL**

A. Sanitary Sewer and Storm Drain: Bedding, pipe zone, and initial backfill material shall be clean free-draining well-graded crushed gravel with a maximum aggregate size of I inch. Crushed rock meeting the gradation requirements shown below shall be submitted for approval by the Engineer.

1-Inch Crushed Gravel

Sieve Size	Percent Passing by Weight
1"	100
3/4"	90-100
½"	20-55
#4	0-1
#8	0-5

B. Water. Gas. Electric, Telephone, or Buried Cables: Bedding, pipe zone, and initial backfill material shall be clean granular natural sand material, free from organic matter, conforming to the gradation requirements shown below:

3/8"	100
#4	35-100
#30	20-100

2.3 **FINAL BACKFILL UNDER STRUCTURES, PAVEMENT, AND WALKS**

A. Fill and final backfill for utilities under and immediately adjacent to structures, pavement prisms, and walks shall be structural fill material consisting of clean, well-graded, non-expansive granular sand and gravel material imported from off-site with a maximum size of 3 inches, no greater than 35 percent passing the No. 200 sieve, and a liquid limit of no greater than 30 percent. The material shall be capable of attaining the required densities when compacted.

B. Native material will be acceptable for final backfill under walks, pavement, or structures if it meets the requirements for structural fill material.

2.4 **FINAL BACKFILL OUTSIDE OF STRUCTURES, PAVEMENT, AND WALKS**

A. Fill and final backfill for utilities not under or immediately adjacent to structures, pavement prisms, and walks, shall be suitable non-structural fill material consisting of excavated material from the site, free from topsoil, debris, trash, roots, and other organic matter, frozen material, and stones larger than 3 inches in any dimension. If an adequate quantity of nonstructural material is not available at the site, provide imported fill or borrow material consisting of any cohesive or granular material free from topsoil, debris, trash, roots, and other organic matter, frozen material, and

stones larger than 3 inches in any dimension. The material shall not contain excessive moisture and shall readily compact and support construction equipment.

B. Whenever the native excavated material is determined by the Engineer to be unsuitable, imported acceptable material, meeting the requirements for material within rights-of-way, and capable of attaining the required densities shall be used.

2.5 PLASTIC MARKING TAPE

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide, with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing, or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in the table below and shall bear a continuous printed inscription describing the specific utility.

Tape Color	**Utility**
Red	Electric
Yellow	Natural Gas, Oil, Dangerous Material
Orange	Telephone, Telegraph, Television, Police and Fire Communications
Blue	Potable Water System
Green	Industrial and Sanitary Sew
Green & White	Compressed Air

PART 3 EXECUTION

3.1 PROTECTION

A. Protect trees, shrubs, and lawn areas to receive planting, rock outcropping, and other features remaining as part of final landscaping.

B. Protect bench marks and existing structures, roads, sidewalks, paving, and curbs against damage from vehicular or foot traffic.

C. Protect excavations and workmen by shoring, bracing, sheet piling, underpinning, or by other methods, as required to prevent cave-ins or lose dirt from falling into excavations.

D. Shore or otherwise support adjacent structure(s) which may be damaged by excavation work. This includes service lines, pipe chases, utilities, retaining walls, etc.

E. Notify Engineer of any unexpected subsurface conditions. Discontinue work in the area until Engineer provides notification to resume work.

3.2 EXISTING UTILITIES

A. The drawings show existing utilities and their locations insofar as they are known. Utility locations and sizes may vary from those shown. Underground utilities or

improvements may exist which have not been shown on the plans. All reasonable precautions shall be taken to field locate, preserve, and protect any and all such improvements.

Any improvements damaged by the Contractor which are not indicated by the drawings shall be repaired by the Contractor. Compensation for such repairs shall be covered by a Field Change Order and will be negotiated with the Engineer before corrections are made. Any such improvements damaged by the Contractor which are on the drawings shall be repaired at the expense of the Contractor.

B. Request various agencies or utility companies concerned to field-mark substructures and utilities before excavating. The Contractor shall call Blue Stakes prior to commencing any work.
C. Where it is necessary to remove, replace, or relocate such improvements in order to execute the Work, coordinate with, and obtain approval from the utility company or agency concerned.
D. If the Contractor damages any existing utility lines that are not shown, or if the locations of suspected utilities are not known to the Contractor, report immediately to the Engineer and the Owner of the utilities.

3.3 TRENCH EXCAVATING

A. Obtain required permits from local or state agencies.
B. In areas requiring re-seeding or sodding, strip topsoil to a minimum depth of 6 inches, or as directed by the Engineer, and stockpile away from trench and other excavated materials for reuse.
C. Vertically cut existing pavement, sidewalk, curb and gutter, driveways, etc., along the lines forming the trench in such a manner as not to damage the adjoining pavement. Break up the portion to be removed, and remove from the site of the work immediately without causing damage to the pavement outside the limits of the trench.
D. Perform trench excavation to the alignment and grade as shown on the drawings, or as required by the Engineer.
E. As directed by the Engineer, when unsuitable foundation material is encountered at sub-grade, remove unsuitable material and replace with foundation material. Contact Engineer prior to excavation of unsuitable material and placement of foundation material to gain authorization to do so.
F. Place excavated material in a manner that will not endanger the work and will cause the least possible interference with public travel.
G. Provide for uninterrupted flow of irrigation ditches, streams, wastewater, and storm drainage. Provide free access to all fire hydrants, water valves, meters, and drives.
H. Keep excavation clear of water during the progress of the Work.
I. The Contractor shall backfill, to existing grades, and barricade all trenches within roadways and parking areas at the close of each day, unless approved by the Engineer. No trenches shall be backfilled except in these areas until pipelines are properly tested.
J. The use of a trench digging machine will be permitted except in places where machines may cause damage to existing structures, in which case, hand methods

shall be employed.

K. Place barriers along each excavation, at each end of excavations, along soft shoulder areas within roadways, and at other locations along the excavation as may be necessary or as required by the Engineer. Trenches shall be delineated night and day as required by applicable codes until backfilling is complete.

L. Equipment with tracks which is to be used on pavement shall be equipped with suitable pads to prevent damage to the pavement. The Contractor shall be responsible for damage done to improved surfaces. Damaged surfaces shall be repaired or replaced by and at the expense of the Contractor in a manner satisfactory to the Engineer and at no additional cost to the Owner.

M. Trenches, at the top of the initial backfill, shall be of necessary width for the proper laying of the pipe, but in no case shall the trench be less than 12 inches wider than the outside diameter of the pipe or more than two 2 feet wider than the pipe outside diameter.

N. Trenches shall not be excavated until the pipe to be laid therein is on the site and is scheduled to be placed. The bottom of the trenches shall be accurately graded to a depth of 6 inches below the bottom of the pipe to allow for placing of granular pipe zone bedding material. Care shall be taken not to excavate below the depths indicated. Where bell and spigot pipe is used, the minimum cover depth shall be maintained over the bell as well as under the straight portion of the pipe. Over-excavation shall be backfilled in 6-inch lifts to the proper grade with foundation or bedding material, as required by the Engineer, and shall be thoroughly consolidated and compacted as specified at no additional cost to the Owner.

O. Wasting of Material: Contractor shall remove and dispose of surplus, unsuitable and excess excavated material. Contractor shall secure waste sites for excess material. No additional payment shall be made for removal and disposal of material.

3.4 ROCK EXCAVATING

A. Rock shall be defined as follows:

1. Rock excavation shall consist of solid material and obstructions encountered with a volume in excess of 2 cubic yard. Sidewalks, pavement, and curb and gutter that cannot be excavated with a track-mounted power excavator (equivalent to Caterpillar Model No, 215C LC, rated at not less than 115 HP flywheel power and 32,000-pound drawbar pull, and equipped with a short stick and a 42-inch wide, short tip radius rock bucket rated at .81 cubic yard (heaped capacity) without systematic drilling and blasting shall be excluded.
2. Hard and compact materials such as cemented gravels, glacial till, fractured quartzites, and relatively soft or disintegrated rock will not be considered as rock excavation. Intermittent drilling, blasting, or ripping that is performed to merely increase production shall <u>not</u> be considered rock excavation.

B. Excavation of the material claimed as rock shall not be performed until the material has been classified and cross-sectioned by the Engineer.

C. Rock payment lines are limited to the following:

1. Six (6) inches below invert elevation of pipe and two feet wider than inside diameter of the pipe, but not more than three (3) feet maximum trench width.

D. Excavate for and remove rock by the mechanical method.
   1. Cut away rock at excavation bottom to form level bearing surface.
   2. Remove shaled layers to provide sound and un-shattered base for footings and foundations.
   3. Remove excavated material.
   4. For utility installations, cut away rock in bottom of trench to follow the proposed grade of the utility line. Eliminate sharp steps or protrusions.

E. Provide for visual inspection of bearing surfaces and cavities formed by removed rock.

3.5 STABILITY OF EXCAVATIONS

A. Slope sides of excavations to comply with OSHA 29 CFR Part 1926 or latest revision. Provide and install trench support systems where sloping is not possible because of space restrictions or stability of material excavated.

B. Provide proper support for all excavations to protect life, property, utilities, pavement, and the Work and to provide safe working conditions in the trench in accordance with Occupational Safety and Health Administration (OSHA) regulations. Federal Register Volume 37, No. 243, Subpart P., Sec. 1926.652 or latest edition.

C. Contractor shall be responsible to determine when and where the use of trench support is employed over the use of trench boxes or sloping the sides of the excavation to the angle of repose of the material being excavated. Contractor shall be responsible for the support system used.

D. Remove all timber and sheeting from excavations or trenching before backfilling. Cut sheeting off 2-feet below final grade if allowed by Engineer.

E. Contractor shall prevent damage to the existing improvements. Where existing improvements are damaged or affected as a result of the Contractor's work, the Contractor shall replace or repair such damage at no additional cost to the Owner.

3.6 DE-WATERING

A. Provide all equipment, labor, materials, tools, and incidentals necessary to design, construct, install, and operate de-watering facilities for construction of the Work.

B. Do not discharge drainage water into storm drains unless approval by the governing agency and the Engineer is given. No discharge into sanitary sewers is allowed.

C. Water shall not be allowed to flow through the pipe lines during construction.

3.7 BACKFILLING AND COMPACTING

A. Assure that trenches are free of debris, snow, ice, and water and that ground surfaces are not in frozen condition.

B. Backfill in a systematic manner and as soon as possible after pipeline installation and leak detection testing is complete.

C. Compact materials in accordance with paragraph 3.14 Field Quality Control.

D. Foundation: When unstable earth, muck, or other foundation material is encountered in the excavation, additional excavation shall be made as directed by the Engineer, and shall be replaced with foundation materials. A minimum of 12 inches below the pipe zone will be removed and backfilled with foundation material

to give a stable sub-grade. No additional payment for foundation material will be made unless the Engineer is notified of the condition and approves the use of foundation materials. In rock excavation where over-excavation occurs the excavation shall be backfilled with foundation material to 6 inches below the pipe zone.

E. Bedding and Pipe Zone: Place bedding material to required thickness and consolidate or compact. Shovel-slice or rod the bedding in the haunch area to assure that the pipe remains true to grade, voids are eliminated beneath the pipe, and the bedding is properly compacted or consolidated.

F. Initial Backfill: Place and compact initial backfill material simultaneously on each side of the pipe for the full width of the trench in layers of 6 inches or less, to a point 12 inches over the top of the pipe and in such a manner as not to injure, damage or disturb the pipe.

G. Final Backfill:
   1. Under structures, pavement prisms, walks, and where specified by the Engineer, the backfill material shall be placed in continuous horizontal layers, not exceeding 6 inches in thickness or as required by Construction Manager. Adjust moisture content of fill or backfill material, as determined by ASTM D698, as necessary to plus or minus 2 percent of optimum moisture as required to obtain specified degree of compaction. Utilize borrow material as available. Provide import structural fill material as required.
   2. In all areas outside of structures, pavement prisms, and walks, place non-structural fill or backfill material in continuous horizontal layers not exceeding 12 inches in thickness degree of compaction. Moisten or aerate native materials as necessary to plus or minus 3 percent of optimum moisture as determined by ASTM D698.

H. In areas where the pipe is placed near the existing ground surface, mound backfill material over pipe to a depth of 4 feet of cover, or as designated on the plans. Mounding shall be accomplished with consideration for drainage problems that may develop. Mounding shall only be used where shown on the plans.

I. Distribute the backfill material in such a manner as to avoid the formation of lenses or layers of material differing substantially in characteristics from surrounding material. Do not include any roots, sod, frozen material or other perishable or unsuitable material in backfill.

J. Whenever the excavated material is not suitable for backfill, furnish or transport from other areas within the project, suitable excavated material which meets the requirements for final backfill.

K. Remove from site and dispose of excess or undesirable excavated material not suitable or required for backfill in an appropriate acceptable manner.

L. Backfill for Appurtenances: After the manhole, catch basin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for seven (7) days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be placed in such a manner as to prevent eccentric loading and excessive stress on the structure.

3.8 SPECIAL REQUIREMENTS

A. Water Lines: Trenches shall be of a depth to provide a minimum cover of 5 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

B. Electrical Distribution System: Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated.

C. Gas Distribution: Trenches shall be excavated to the depth that will provide not less than 36 inches of cover. Trenches shall be graded as specified for pipe-laying requirements.

D. Plastic Marking Tape: Warning tapes shall be installed directly above the pipe at a depth of 18 inches below finished grade unless otherwise shown or required by the Engineer.

3.9 SOIL STORAGE (STOCKPILE) AREAS

A. Prepare areas to receive stockpile material. Clear and grub as necessary to prevent stockpiled material from contamination with unsuitable material.

B. Provide adequate drainage for stockpiles and surrounding areas by means of temporary ditches, dikes or other approved methods.

C. Stockpile suitable excavated material in an orderly manner, and at a distance from the bank of the excavation sufficient to avoid overloading or cave-ins.

D. Protect stockpiled material from contamination with unsuitable excavated material that may destroy the quality of the suitable stockpiled material. Replace stockpiled material, not adequately protected, that becomes unsuitable with suitable material at no cost to the Owner.

E. Do not place stockpile material in permanent fill material locations unless approved by the Engineer.

F. When stockpile areas are no longer needed, prior to completion of the work, grade the stockpile area to original contours and abandon/fill temporary ditches.

3.10 BORROW AREAS

A. Excavate borrow areas in such a manner as will afford adequate drainage.

B. Transport overburden and spoils material to the designated spoil area or otherwise dispose of as directed by the Engineer.

C. Operate borrow areas to minimize detrimental effects on natural environmental conditions.

D. Maintain access roads as required to permit access.

E. Slope sides of excavations or provide excavation support systems in accordance with Section 02160.

F. Trim and drain borrow areas to neat lines after the excavation is complete.

3.11 COLD WEATHER

A. Contractor shall remove and dispose of snow or ice from the construction area as necessary to perform the required work. The removal of additional deposits of snow shall not be cause for the Contractor to request an extension of contract time or additional payment.

B. The Contractor shall provide cold weather protection materials and equipment, such as heaters and blankets, as required.
C. Excavations, trenches, excavated material, and imported material shall be protected from frost or freezing, as necessary, until the excavation or trench has been backfilled.
D. The presence of frozen material or material containing frost shall not be cause for the Contractor to request an extension of contract time or additional payment.
E. The Contractor shall remove and dispose of frozen material that cannot be incorporated into the backfill.

3.12 FIELD QUALITY CONTROL

A. Densities of in-place materials shall equal or exceed the minimum densities as indicated below when compared to the maximum dry density as determined by ASTM D698:

COMPACTION REQUIREMENTS	
Location or Use of Fill	**Percent of Maximum Relative Density**
Foundation, bedding, and initial trench backfill or fill material	95
Final fill and backfill beneath structures, paved areas (including sidewalks and gravel roadways)	95
Final fill and backfill, not beneath paved areas or structures	90
Topsoil	80
Over-excavation	95

B. Passing over-excavation tests are required on the fills and backfills at the following frequencies:

Bedding .....1 Test per 200 L.F. of Trench
Initial Backfill .....1 Test per 200 L.F. of Trench
Final Backfill or Fill.....1 Test per 200 L.F. of Trench per lift (outside pavement section)
Final Backfill or Fill .....1 Test per 50 L.F. of Trench per lift (under pavement section)
Over-excavation .....1 Test per 50 L.F. of Trench per lift

C. Densities of in-place material shall be as determined by ASTM D2922.
D. Compaction tests not meeting specification requirements shall be retested, after re-compaction, at Contractor's expense. The Engineer shall select the depth that the test is to be taken. The Contractor shall be responsible to dig all density testing pits at the location and depth requested. No additional payment will be made for test pits

dug for compaction tests or for replacing and re-compacting the backfill material.

E. Fill or backfill not compacted to the required density will be removed, re-compacted, and retested at the Contractor's expense until the requirements are met. The retesting shall be at the Contractor's expense.

F. Any trenches and excavation pits improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and compaction, rounded over, and smoothed off or pavement sections restored.

G. The Contractor shall be responsible for providing Proctor Density test results for backfilled material, bedding material, and any special import backfill used. Prior to commencement of any construction the Contractor shall obtain samples of backfill material for Proctor tests. Where existing material is to be used as backfill material the Contractor shall be responsible for providing the machinery and labor to obtain soils samples of the backfill material for Proctor tests. On this project at least one sample per 1000 feet of pipe to be installed shall be required. Additional Proctor tests may be required if backfill material changes in characteristics. Proctor tests shall be run by a Owner-approved testing laboratory. The cost of obtaining soil samples and conducting Proctor tests shall be paid by the Contractor. No pipeline installation will begin until written results of the Proctor tests for that area have been submitted to the Engineer. The Contractor shall use the Proctor test results for testing compaction of backfill material.

3.13 LIMITS OF CONSTRUCTION

The Contractor shall complete all work within the easement lines and rights-of-way as shown on the drawings or as directed by the Engineer. All corrections for disturbance, damage, or irregularity shall be the responsibility of the Contractor and shall hold the Owner harmless of all suits, liability and damages. All ditches, canals, and roadways shall be placed back into their original or better condition.

3.14 CLEAN UP

A. Remove all excess material, debris, sheeting, etc. from the site upon completion of the Work and dispose of properly.

B. Keep cleanup operations to within 500 feet of excavation at all times.

C. Failure to keep the cleanup operations to within 500 feet of excavation shall be sufficient cause for the Engineer to stop forward progress of excavating equipment and hold progress payments until the cleanup is up to acceptable limits and standards.

D. Any pavement, trees, shrubbery, fences, poles, or other property or structures damaged, removed, or disturbed by the Contractor, whether deliberately or through failure to carry out the requirements of the contract documents, state laws, municipal ordinances or the specific direction of the Engineer or through failure to employ usual and reasonable safeguards shall be replaced or repaired at the expense of the Contractor.

E. It shall be the Contractor’s responsibility to insure that all mud, gravel, or other debris generated by construction traffic during the course of this project installation is not tracked onto local roads and streets. Any mud or other debris tracked onto

streets shall be immediately cleaned up by the Contractor at his expense. In no case shall such material be allowed to sit on the road overnight.

END OF SECTION

SECTION 02810

UNDERGROUND IRRIGATION SYSTEMS

This specification replaces Section 02810 of the APWA Manual of Standard Specifications. All other provisions remain in full force and effect.

Delete the existing section and replace with the following:

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Underground irrigation systems complete with heads, valves, controls, and accessories.

B. Related sections:
   1. Section 02055 Common Fill
   2. Section 15011 Ductile Iron Pipe
   3. Section 15014 Polyvinyl Chloride Pipe.

1.2 REFERENCES

A. Reference standards:
   1. NFPA 70: National Electric Code.

1.3 PERFORMANCE REQUIREMENTS

A. The work to be performed under this Section shall consist of furnishing all labor and materials necessary to construct a complete working and tested underground sprinkler irrigation system per all drawings and specifications, providing 100 percent coverage on all lawns and planting areas on the site. Included also will be maintenance and warranties.

B. The Contractor shall perform, but not be limited to, all of the following functions: paying all connection fees, deposits and all other charges related to the connection to the water source; obtain all permits; complete all excavation and backfill; provide backflow device, tapping saddle, yoke, stop and waste, corp. cock, concrete vaults and miscellaneous pipe fittings; make necessary road repairs; provide safety barrier; and make connection to water source. All work shall be in compliance to applicable codes and requirements of the utility companies involved.

C. If any or all of the above mentioned fees or charges are not listed on the bidding schedule or on plan, they shall be included in the bid lump sum price of the irrigation sprinkling system item.

D. Contractor shall verify with the appropriate water district the location of the water service main line and complete all requirements to bring water service to the site. Total cost to be included in the irrigation sprinkling system bid item.

E. The above specification statement supersedes the graphic representation location of the contract limit line. This pertains to the water line location on either side of the street adjacent to the project site.

F. All work shall be done in accordance with the drawings and specifications, as well as all applicable water and electrical codes.
G. The Contractor shall operate, maintain until acceptance, and guarantee the new system until all lawn and plants planted on this project have become established and have been approved by the Landscape Architect.

1.3 **SUBMITTALS**

A. Product Data: Manufacturer's technical data and installation instructions.
B. Pipeline Test Report: In accordance with Section 01815.

1.4 **QUALITY ASSURANCE**

A. Testing agency: Pipe pressure testing during construction will be conducted by the Contractor.

1.5 **PROJECT CONDITIONS**

A. Any discrepancies between existing site conditions and those indicated on the plans shall be called to the attention of the Inspector and/or Landscape Architect, prior to continuance of the project.
B. The Contractor shall use only the equipment and products specified in the construction drawings. No substitution of materials will be allowed on the irrigation system without prior authorization from the Landscape Architect and the Owner.

PART 2 PRODUCTS

2.1 **GENERAL**

A. All materials shall be manufactured by United States companies.
B. Handling and unloading of all equipment, pipe, and fittings shall be in such a manner as to insure delivery at the job site in a sound, undamaged condition. Any equipment or pipe found to be damaged or defective in workmanship or materials shall be rejected or taken out if found installed.

2.2 **PIPE**

A. All pipe, 4 inches inside diameter and smaller (including all fittings), shall be Schedule 40 PVC unless otherwise specified. See detailed drawings.
B. All pipe, 6 inches inside diameter and larger (including all fittings), shall be PVC (except as required for conversion to metal fittings), Class 200.
C. No bends in pipe shall be permitted. The Contractor shall use elbow fittings of 90, 45, and 22.5 degrees as individual situations demand.

2.3 **FITTINGS**

A. All fittings on PVC pipe shall be Schedule 40 or 80 PVC, including conversions to metal pipe and fixtures. The fittings shall conform to ASTM D-2466.
B. All tees coming out of main lines or valves and other fixtures, shall be horizontal so that no weight or pressure may be exerted through the fixture on the top or bottom

of the main line. Tees shall be Sch. 80 SxSxS with SxT Sch. 80 bushing of appropriate size to the valves and Sch. 40 SxT tees for the heads. See detailed drawings.

C. All tees coming out of the lateral lines for heads and other fixtures shall be horizontal so that no direct weight or pressure may be exerted through the head to the top or bottom of the lateral line. Tees on lateral lines shall also be SxSxT to the head swing joints. See detailed drawings.

2.4 GATE VALVES

A. Gate Valves shall conform to AWWA specification C 509. They shall be of Class 200 cast iron body. Resilient-seated Gate Valve and shall have a non-rising stem with rubber "0" rings. Stems shall be of cold rolled, solid bronze, high tensile strength. Valve shall be high strength cast iron, fully encapsulated urethane rubber wedge. Gate valves shall be hydrostatically pressure tested for 400 P.S.I. and shall be designated for a working pressure of 200 P.S.I. shall be an American-made waterous brand.

B. Unless otherwise shown or specified, valves sized 3" and larger shall have flanged end connections. Valves 2-1/2" and smaller shall have threaded end connections i.e., #T113 non-rising stem. Buried valves shall have 2" square operating nuts. No handles or wheels will be permitted. Valves inside structures shall have wheel handles. Unions shall be installed on each side of all valves except flanged valves. Each valve shall contain a resilient wedge urethane rubber seat.

C. The Contractor shall provide adequate material for the connection of valves to the system, i.e., adapters, flanges, nuts, bolts, gaskets, etc.

D. All main line buried gate valves shall be fitted with a 4" minimum diameter pipe sleeve and 10" round "Brooks" bolt down box. Install a quick coupler just down stream of each gate isolation valve, for blow out purposes.

2.5 QUICK COUPLING VALVES

A. Quick coupler valves shall be installed where specified on the plans. Each valve shall be heavy duty brass, two-piece, single lug locking cap.

B. Quick coupler valves shall be installed within a 10" round Brooks Box unless next to concrete pad, then install to grade.

C. The Contractor shall provide to the Landscape Architect at least 1 cap lock key and 1 quick coupling key with a swivel hose bib attached. These keys shall be delivered prior to final acceptance of the project.

2.6 CONTROL VALVE ASSEMBLY

A. Control valves shall be installed as specified by the plans. Each valve shall be globe diaphragm and electrically activated as specified on the plans. No valve shall be installed more than 12 inches below finished grade. All pipe on the control valve manifolds shall be Schedule 80 PVC pipe. See detailed drawings.

2.7 MANUAL DRAIN VALVE ASSEMBLY

A. Manual drain valves shall be required at all low points in the main lines. See plans, notes, and details.

B. All manual drains shall be Ford B11333 heavy duty brass, ball valves.
C. The location of each manual drain shall be shown on the "as built" drawing with dimensions from the nearest permanent fixture, such as a building corner, etc.
D. Each manual drain valve will be accessed by a 2 inch PVC Schedule 40 pipe sleeve, capped by a locking valve cap with a key, enclosed within a 10" round Brooks bolt down box. Top of drain sleeve shall be 3" - 6" below lids of Brooks box.
E. Each manual drain shall empty into a gravel sump, a minimum of 18 inches by 18 inches by 12 inches deep. The gravel shall be washed 3/4 inch rock.

2.8 AUTOMATIC DRAIN VALVES

A. Automatic drain valves shall not be used on this project.

2.9 VALVE BOXES

A. All control valves shall be housed in a Brooks 1419 standard series heavy duty plastic valve box with a locking lid. No valve box shall rest directly upon the valve or any fixture associated with it. Each valve box shall be centered on the valve it covers. Each valve box shall have 2 inches of pea gravel placed in the bottom underneath the valve and lines to reduce the potential of mud and standing water therein.

2.10 CONTROL VALVE WIRE

A. All irrigation control wire shall bear approval as U.L listed type of underground feeder and each conductor shall be of electrical conductivity grade solid copper in accordance with ASTM-30. **No aluminum wire shall be used on this project!** All control wire shall be specifically designed for direct burial use. Sizes shall be #14 UF. A minimum loop of 24 inches shall be left at each valve, at each splice, and at each controller for expansion and/or servicing of the wire. All splices shall be water-tight. All wire, crossing water, attached to bridges, going under paving, or where conditions require protection, shall be housed in conduit or sleeves, all out of ground conduits shall be metal rigid conduit. All buried conduit can be PVC conduit.
B. All connections made inside the box to connect wires to the valve shall be made inside a Spears dry-splice connector or 3M-DMY connector. Each connector shall be completely sealed and water-proof.
C. All splices in control wire shall also be housed in a valve box, as specified above.
D. Multiple wires in the same trenches shall be banded together at 10 foot intervals for protection. Where wires pass under paved areas, Schedule 40 PVC sleeves shall be installed prior to installation of the paving, if possible, and prior to installation of the wires. Sleeves shall be sized as follows: 1-11 wires in 1-1/4 inch pipe; 12-15 wires in 1-1/2 inch pipe; etc.
E. All common or ground wires shall be White. Where more than one controller is required, a different color hot wire shall be used for each controller. Two spare wires shall be run from each controller. Two spare wires shall be run from each controller to the farthest valve under its control in all directions and any valve which is on a dead-end line. The spares shall also be a different color from the regular wires and shall be labeled at both ends. Each spare wire shall be brought up

to the surface in each valve box it passes through and coiled with 24 inches for use in future connections. Each spare wire shall be tested for continuity prior to final acceptance of the project and guaranteed by the Contractor to be functional. Should the maintenance personnel discover a defect within 1 year afterwards, the Contractor shall locate the problem and cause it to be repaired at his cost. Install extra wires as needed for moisture sensors.

F. The pigment or color of the wires shall be integrated into the covering, rather than painted on.

G. All control wires shall be installed in trenches 6 inches to either side of the pipes so that the wire is protected from damage during backfilling and maintenance operations. See detailed drawing showing the wire located in those positions. Control wires not placed in the trenches by the sides of the pipes, shall be buried 18 inches or deeper and marked on the "as built" drawings.

2.11 SPRINKLER HEADS

A. All heads used on this project shall be as specified in the Irrigation Equipment Schedule shown on the plans.

2.12 BACKFLOW PREVENTION ASSEMBLY

A. Backflow prevention devices shall be a reduced pressure principle backflow preventer consisting of a pressure differential relief valve located between two independently operated spring-loaded “Y” type center guided check valves. Assembly shall also have two full port resilient seated ball valves for shut-off and four resilient seated ball valve test cocks and bronze body construction. Larger sizes (2 ½" and up) may have two non-rising stem resilient wedge gate valves in lieu of ball valves.

B. Install according to all local, state, and national codes and regulations, and per manufacturer’s recommendations.

2.13 AUTOMATIC CONTROL SYSTEM

A. Furnish low voltage system manufactured expressly for control of automatic control valves used in an underground irrigation system. Provide adequate capacity to accommodate each valve on the system separately. Do not double valves to circuits.

B. Install the brand and model of controller as specified in the Irrigation Equipment Schedule. No substitutions shall be allowed.

C. Controller enclosures shall be vandal and weather resistant, manufactured of 100% stainless steel, with 3-point locking mechanism, flush mounted access handle and heavy duty continuous hinge, and side louvers at bottom and top for cross ventilation.

2.11 DRIP IRRIGATION

A. Drip emitters shall be of the individual, self-cleaning, pressure-compensating type.

B. Tubing shall be constructed of high quality linear, low density, UV-resistant, polyethylene resin materials with internal, integral emitters at specified intervals.

C. All insert barbed fittings shall be constructed of molded, UV-resistant plastic. Each fitting shall have a minimum of two ridges or barbs per outlet. All fittings shall be of one manufacturer and shall be available in one of the following end configurations:
   1. Barbed insert fittings.
   2. Male pipe threads (MPT) with barbed insert fittings
   3. Female pipe threads (FPT) with barbed insert fittings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Visit: Visit and inspect site; take into consideration known and reasonably inferable conditions affecting work. Failure to visit site will not relieve Contractor of furnishing materials and performing work required.

3.2 CONSTRUCTION STAKING

A. The Contractor shall provide the necessary staking to obtain the layout shown on the plans. The points of reference shall be the existing walks, buildings, curbs, etc. The staking shall be approved by the Landscape Architect prior to commencing installation operations. Any changes in the system which appear necessary due to field conditions must be called to the attention of the Landscape Architect and approved at the time they are discovered and prior to making the change.

3.3 EXCAVATION AND BACKFILLING

A. Excavation:
   1. Excavation work shall be as deep and as wide as will be required to safely perform the work, such as making mainline connections or forming vaults.
   2. Trenches shall be deep and wide enough to provide working space for placing 2 inches of mortar sand bedding underneath all new mainline pipe and fittings where the soil is rocky or gravelly. Place 18 to 30 inches of cover over the top of all pipe and fittings on main lines (lines which maintain a constant water pressure). All trench bottoms shall be sloped so that the pipe will gravity drain back to the main connection point or the nearest manual drain. If the existing main line is deeper than 30 inches, the Contractor shall install a riser to a depth of 18 to 30 inches and then install the new line at the required 18-30" depth. At no time will the mainline be installed deeper than 30" unless prior approval by Landscape Architect or Inspector.
   3. Trenches for lateral and supply lines (lines which carry water to the heads), shall be deep enough to maintain 8 to 14 inches of cover over the top of all pipe and fittings. Trenches shall also be deep enough to guarantee that all swing joints drain back to the lateral and supply lines. Lateral lines may be pulled by a mechanical puller provided all other applicable specifications are met.
   4. Trenches for lines supplying small heads shall be deep enough to maintain a

minimum of 8 to 12 inches of cover over the top of all pipe and fittings. Trenches for these lines shall be a minimum of 6 inches away from any walks, curbs, and of sufficient width to accommodate tees coming out sideways (horizontally) from the laterals. This also includes the other fittings which carry the small heads.

5. Any rocks or other debris over one inch in diameter uncovered during excavation or trenching shall be removed from the area.
6. If more than one line is required in a single trench, that trench shall be deep and wide enough to allow for at least 6 inches of separation, both vertically and horizontally between pipes.
7. Any existing utility lines damaged during excavating or trenching shall be repaired immediately after notification of the utility owner and to his satisfaction. Should utility lines be encountered, which are not indicated on the plans, the Engineer or Landscape Architect shall be notified. The repair of any damage shall be done as soon as possible by the Contractor or the utility owner, and proper compensation will be negotiated by the District. Such utility locations shall be noted on the "as built" drawings required before final payment of the sprinkler irrigation system contract.
8. Where trenching is done in established lawn, care will be taken to keep the trenches only as wide as is necessary to accomplish the work. The trenches shall be backfilled as specified above and then 4 inches of topsoil will be placed to bring the trench up to existing grade so that sod can be laid. The new sod shall be first grade sod of standard width and shall be laid along the trenches so as to match the existing sod. No small pieces of sod shall be used and only standard lengths shall be accepted. No sod from the construction site shall be used unless otherwise specified.

B. Backfilling:

1. No backfilling of trenches shall be done until the system has been inspected for proper trench depths, installation of equipment, control wire, and location of heads by the Landscape Architect or Inspector.
2. Before trenches are backfilled, the Contractor must show the Landscape Architect or Inspector, the redlined "as built" drawing he has been keeping on the site, showing that changes and corresponding dimensions have been recorded where changes have been made.
3. Prior to backfilling, the system shall be tested under pressure for leaks and general operation of the equipment. The main line shall be tested for a period of 4 hours at a pressure of 120 PSI. Lateral lines shall be tested for 1 hour at design pressure, which is 60 PSI. Any failures detected during the testing period shall be repaired by the Contractor and the testing shall be repeated. The Landscape Architect or Inspector shall certify the testing to insure that it has been completed and that the system passed the test. All defects discovered by the pressurization and operation test shall be corrected before proceeding with further work.
4. Backfill under and around the lines to the center line of the pipe shall be placed in maximum layers of 6 inches and thoroughly compacted.
5. Special care shall be taken to assure complete compaction under the haunches

of the pipe. Backfill compaction under the haunches of the pipe shall be compacted to the original density. Compaction requirements above the pipe shall be the same as for surrounding areas.

6. No rocks larger than 1 inch in diameter nor any other debris shall be backfilled into the trenches. All trenches shall be backfilled then saturated with water sufficiently to insure no settling of the surface after lawn is planted or sod is replaced.

3.4 SPRINKLER HEADS

A. All heads shall be installed above grade so as to minimize washing of the top soil and seed during the landscaping establishment period, except those which border paving or flat work of any kind. These heads shall be installed at the finished grade of the adjacent paving or flat work. Prior to final acceptance of the project, all heads shall be raised or lowered to final lawn or planting grade.

B. Heads installed in existing sod shall be set at the grade of the soil.

C. All rotary pop-up heads shall be installed at final grade on double swing joints. See detailed drawings in the section following this one. All swing joints must drain by gravity back to the supply lines.

D. All pop-up, shrub spray, lawn spray, bubbler and strip spray heads shall be installed as shown in the details.

E. All pipes, lines, and risers shall be flushed thoroughly with water before installation of any heads. All debris and rocks found at that time shall be removed from the area as soon as possible.

3.5 PIPE SLEEVES

A. Pipe sleeves shall be required under all new concrete or other new paving. The size of the sleeve shall be at least twice the size of the pipes or wires to be sleeved. Wires shall be sleeved separately within their own sleeve. All pipe sleeves 4" and smaller in diameter shall be PVC Schedule 40 pipe; sleeves greater than 4" in diameter shall be CL. 200 PVC.

3.6 THRUST BLOCKS

A. Thrust blocks are needed wherever the main pipe line:
   1. Changes any direction at tees, angles, and crosses vertical and horizontal.
   2. Changes size at reducers.
   3. Stops at a dead-end.
   4. Valves at which thrust develops when closed.

   The size and type of thrust block depends on pressure, pipe size, kind of soil, and type of fitting. As a general rule, one cubic foot (minimum) of class AA(AE) Type II concrete is required for each thrust block.

B. Thrust blocks shall rest against undisturbed original earth in the direction of thrust.

C. Where a fitting is used to make a vertical bend, use a bar to anchor the fitting to a thrust block braced against undisturbed soil. The thrust block should have enough resistance to withstand upward and outward thrusts at the fitting.

3.7 BACKFLOW PREVENTION ASSEMBLY

A. The Contractor shall install backflow prevention equipment behind the point of connection (downstream) to the supplying utility lines and shall comply with local water district or State (whichever is most restrictive) requirements for such. See plans and details for more information. Install a quick coupler just down stream of backflow prevention assembly for blowout purposes.

3.8 ELECTRICAL POWER SUPPLY

A. If electrical service is not already in place, the Contractor shall be required to make all necessary arrangements with the appropriate power company, including but not limited to, paying fees, making power connections, providing poles, weatherhead and meter, etc., as specified on the plans.

3.9 PIPE AND FITTINGS

A. The ends of all pipe shall be reamed and free of all inside scale or burrs. Threads shall be cut clean and sharp, and to a length equal to 1-1/8 times the length of the female thread receiving the pipe. The threaded pipe shall be screwed into a full length of the female thread.

B. All pipe joints shall be properly sealed with teflon tape properly applied to the areas to be joined.

C. Every care shall be taken during installation to prevent dirt and debris (especially rocks) from getting into the pipes.

3.10 INLINE DRIPPERS

A. Drip tubing with pressure compensating emitters shall conform to the following:
   1. Tubing shall be constructed of high quality linear, low density, UV-resistant polyethylene resin materials with internal, integral drippers at specified intervals.
   2. Drippers or emitters shall be of the individual, self-cleaning, pressure compensating type.

B. Inline drip tubing shall be spaced at a distance equal to or less than the inline emitter spacing. For slope applications, place drip tubing laterals parallel to the slope contour. When slopes exceed 3%, increase the recommended lateral spacing by 25% on the lower 1/3 of the slope.

C. All insert barbed fittings shall be constructed of molded, UV-resistant plastic. Each fitting shall have a minimum of two ridges or barbs per outlet. All fittings shall be of one manufacturer and shall be available on one of the following end configurations:
   1. Barbed insert fittings
   2. Male pipe threads (MPT) with barbed insert fittings
   3. Female pipe threads (FPT) with barbed insert fittings

D. All drip tubing shall be held in place by soil staples and shall conform to the following:
   1. Sandy Soil - One staple per every three (3) feet and two (2) staples on each change of direction (tee, elbow, or cross)
   2. Loam Soil - One staple every four (4) feet and two (2) staples on each change of

direction (tee, elbow, or cross)
3. Clay Soil - One staple every five (5) feet and two (2) staples on each change of direction (tee, elbow, or cross)

E. Each remote control valve assembly shall contain the following components:
1. PVC ball valve
2. Inline disc or screen filter with 100 micron/150 mesh filter element
3. Remote control valve capable of operating at very low flow levels
4. Inline pressure regulator

All components shall be installed according to manufacturer's recommendations, and located within a single valve box, one valve per box (no multi-valve assemblies permitted).

F. Provide the following equipment to each valve circuit, located and installed per manufacturer's recommendations:
1. Line flushing valve(s) - minimum of one on each exhaust header and one for every 15 gpm in the circuit.
2. Air/Vacuum relief valve(s) at all high points in the system.

G. Inline dripper tubing shall be installed at finished grade with soil staples and covered with three (3) inches of specified mulch. Supply and exhaust headers shall be installed at normal lateral line depths.

H. Installation of inline drip circuits shall generally conform to the following steps:
1. Assemble and install ball valve, filter, remote control valve and pressure regulating valve assembly in accordance with installation details.
2. Assemble and install supply header(s) in accordance with installation details. Tape or plug all open connections to prevent debris contamination.
3. Install lateral drip lines in accordance with details and relevant specifications and manufacturer's recommendations. Tape or plug all open ends while installing to prevent debris contamination.
4. Assemble and install exhaust header(s) in accordance with installation details. Tape or plug all open connections to prevent debris contamination.
5. Install air/vacuum relief valve(s) at the zone's highest point(s) in accordance with installation details.
6. Thoroughly flush supply header(s) and connect drip lateral lines while flushing.
7. Thoroughly flush drip lateral lines and connect to exhaust header(s) and any interconnecting lateral lines while flushing.
8. Thoroughly flush exhaust header(s) and install line flushing valves in accordance with details.

3.11 **AS-BUILT DOCUMENTS**

A. The Contractor shall keep, as his work is installed, an accurate record of exact dimensioned locations, grades, elevations, and the size of all exterior and interior underground piping, valves, and drains. Dimensions shall indicate distances from columns, buildings, curbs, and similar permanent features on the site. This information shall be recorded on a print as the work progresses, but shall be permanently recorded on a reproducible 2 mil mylar original which shall be given to the Landscape Architect before the project is accepted. The mylar shall be a copy of the original plans for the project produced by a local printer at the Contractor's expense.

B. Final payment for the contract will not be processed until "as built" drawings or plans are received by the Landscape Architect.

3.12 OPERATIONAL TEST AND MAJOR INSPECTIONS

A. When installation of all equipment is complete, and backfilling and grading operations are substantially complete, the Contractor shall call for an operational test and major inspection of the sprinkler irrigation system. Notice by the Contractor shall be given, in writing, 3 days in advance to the Landscape Architect so that proper scheduling can be done for those who are to attend.

B. At the appointed time, an inspection of all valve boxes, controllers, gate valves, and heads shall be made. The entire system will be tested to check for pressure, operation, water coverage, and head adjustment. A list of discrepancies (punch list), shall be written within 3 days and distributed as needed. Each item on the list shall be corrected before the system will be approved by the Inspector who will notify the Landscape Architect before payment will be made. The Contractor will be back charged for time spent by the Owner and any consultants who have been brought to the site for a final inspection when the project is not ready for a final inspection.

3.13 GUARANTEE AND MAINTENANCE

A. Guarantee

1. Upon acceptance of the sprinkler irrigation system as being operational and properly installed, the Contractor shall guarantee the workmanship, materials, fixtures, and equipment to be free from defects for 1 year after that date.
2. The Contractor shall insure and guarantee complete drainage of the system. In working with or connecting to an existing system, he shall guarantee compatibility in operation and drainage between the two systems.

B. Maintenance

1. In the fall of the year during the installation and guarantee period, the Contractor shall meet with the Owner’s maintenance personnel on the site. The Contractor shall winterize the system by draining all of the water and doing everything necessary to insure protection of the system until spring. Blowing out the lines by compressor shall be permitted during the 1 year guarantee. The individuals involved from both parties shall exchange all information necessary for the eventual take-over of the system by the Owner.
2. The Contractor, with the Owner’s maintenance personnel, inspector, or Landscape Architect in attendance, shall energize the sprinkler irrigation system again the following Spring and shall repair all defects found as a result of winter damage, improper installation, improper maintenance, defective materials or inadequate sprinkler drainage.
3. The Contractor shall coordinate with the landscaping sub-contractor during the entire landscaping and lawn establishment period on the use, scheduling, and maintenance of the sprinkler system.

3.14 FINAL INSPECTION

A. At the end of the guarantee period, when the lawn and landscaping have been

approved, the Contractor shall call for a final inspection of the sprinkler irrigation system. There shall be 5 days notice given, in writing, to the Landscape Architect, prior so that the appropriate people may attend.

B. Prior to that time, all heads shall have been adjusted to their proper pattern, radii, and height. The system shall have been flushed out, checked for operation, and any defects corrected. The entire system will be inspected and checked to determine if everything is in working order and ready to be turned over to the Owner. A final list of items found in need or correction (if any), will be made and the Contractor shall correct them. The Inspector will notify the Project Landscape Architect when he has verified that every item is acceptable. Upon acceptance of the system by the Landscape Architect, the Owner shall assume all responsibility for the system.

END OF SECTION

SECTION 02910

PLANTING

This specification adds a new section to the APWA Manual of Standard Specifications. All other provisions remain in full force and effect.

Add the following new section:

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Plants and groundcover requirements.
   2. Bedding, topsoil, and temporary support.

B. The work to be performed under this section shall consist of furnishing all materials, labor, and plants necessary for the proper planting or all trees, shrubs, and groundcover of the kind and sizes specified where applicable, at the prescribed location, and otherwise in accordance with the drawings and specifications or as directed by the Landscape Architect.

1.2 REFERENCES

A. ANN: American Associations of Nurserymen, Inc.
B. ANSI Z60.1: American Standard for Nursery Stock.
C. FS O-F-241: Fertilizers, Mixed Commercial.

1.3 QUALITY ASSURANCE

A. Perform work in conformity with applicable requirements of AAN.
B. Obtain nursery stock and other plant materials form approved sources prior to order and delivery.
C. Provide plants that are declared free of disease and insect pests.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Exercise care in digging, transporting, handling, and packing of all plants.
B. Handle plants so roots are protected at all times. If delivery is in open vehicles, cover entire load without causing over heating.
C. Deliver plant material immediately prior to placement. Keep plant material moist.
D. Protect root balls from sun and wind by covering with soil or other suitable material if not planted immediately on delivery.
E. Store fertilizer in a weatherproof location such that its effectiveness will not be impaired.

1.5 ACCEPTANCE

A. Plants shall be accepted if ball of earth surrounding roots has not been cracked or broken.
B. Plants shall be accepted if burlap, staves, and ropes required in connection with transplanting are installed and still intact upon delivery.

C. Heeled in stock from cold storage shall not be accepted.

1.5 **SAMPLES**

A. Samples of materials listed below shall be submitted to the Landscape Architect for inspection and approval prior to the beginning of work under this contract.

B. Delivery of materials may begin only after samples have been approved. All materials furnished for the work shall conform in every respect to the approved samples. Any non-conforming materials will be rejected.

PART 2 PRODUCTS

2.1 **GENERAL**

A. Provide plants of normal growth and uniform height, according to species, with straight canes and well developed leaders, roots, and tops.

B. Provide plants of sizes indicated; size stated in each case being interpreted to mean dimensions of plant as to stands in its mature position in nursery without straightening of any branches or leaders.

C. Provide legible labels attached to all plants, specimens, bundles, boxes, bales, or other containers indicating botanical genus, species, and size of each.

D. Plants cut back from larger sizes to meet specifications shall be rejected.

E. Balled and burlapped deciduous shrubs will be acceptable in lieu of container growth deciduous shrubs subject to limitation of container grown stock.

2.2 **TREE STAKES**

A. Tree stakes shall be two (2) inch by two (2) inch by eight (8) foot wood stakes used as indicated on the plans. Steel stakes may be used if approved by the Landscape Architect and reclaimed after one year.

2.3 **PLANTS**

A. All plants shall comply with Federal and State Laws requiring inspection for plant disease and infestations.

B. Any inspection certificates required by law shall accompany each delivery of plants and such certificate will be filed with the Landscape Architect. All plants shall be subject to inspection and approval at the place of growth or upon delivery to the site for their quality, size, species, and variety. Such approval shall not impair the right of inspection and rejection at the site or during progress or work for size and condition of the plants, latent defects, or injuries. Any and all rejected plants shall be removed immediately from the premises by the Contractor. The Contractor shall make all replacements at his expense should he fail to comply in full with any of the specifications. Necessary replacements will be made as soon as weather conditions permit and all such plants replaced shall conform to all specifications herein.

C. Names and Grades:

1. Plant names shall conform to the nomenclature of “standardized plant names” as adopted by the American Joint Commission on Horticultural Nomenclature, 1942 Edition. The names and varieties included therein are generally in conformity with the names accepted in the nursery trade.

2. Size and grading standards shall conform to those of the American Association of Nurserymen, Inc., as published in "American Standard for Nursery Stock", 1959 Edition, with all current revisions unless otherwise specified.
3. The caliper of trees shall be measured six (6) inches above the surface of the ground.
4. Measurements on all trees and shrubs shall be taken with the branches in a normal position. Height and spread dimensions specified refer to the main body of the plant and not from branch or root tip to tip. No trees which have had their leaders cut or so damaged that cutting is necessary, will be accepted.

D. No substitution of size, grade, variety or any species shall be permitted except by written permission of the Landscape Architect.

E. Plant Size:
1. All plants shall conform to the size, age and condition as specified in the plant list shown on the drawings. Undersized plant material will not be approved.
2. No additional compensation shall be due the Contractor if larger than specified plant material is provided.
3. Due to the large size of the trees and evergreens being specified, only balled and burlapped or container stock will be accepted. No bare root stock will be accepted. The tree planting details may show bare root trees, but container stock shall be planted as shown in the planting detail.

F. Plant List:
1. Plants lists indicate minimum size requirements only. Plant materials shall be equal to or greater in size than those specified.
2. Any discrepancies between plant lists and plans shall be brought to the attention of the Landscape Architect immediately.
3. In all cases the Contractor shall be held responsible for all plant materials indicated on the plans unless otherwise directed in writing by the Landscape Architect.
4. Each bidder shall investigate sources of supply and satisfy himself that he can supply all of the plants mentioned in the planting lists in size, variety, and quantity noted and specified before submitted his bid. Failure to take this precaution will not relieve the successful bidder from his responsibility as Contractor to furnish and install all plant material in strict accordance with the contract requirements without additional expense to the owner.

G. All plants shall be fresh and vigorous, and of normal habit and growth, and free of disease, insects and insect eggs and insect larvae, weeds and weed seed. No heeled-in plants from cold storage shall be accepted except on approval by the Landscape Architect prior to planting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Visit: Visit and inspect site; take into consideration known and reasonably inferable conditions affecting work. Failure to visit site will not relieve Contractor of furnishing materials and performing work required.

3.2 **PLANTING SEASONS**

A. No planting shall be done in frozen soil or during unfavorable weather conditions, subject to the approval of the Landscape Architect or his representative.

3.3 **PLANT CONDITION**

A. All precautions customary in good trade practice shall be taken in preparing plants for planting and workmanship that fails to meet the highest standards will be rejected. All balled and burlapped plants shall have firm and natural balls of earth. No plant shall be planted in the ball is cracked or broken either before or during the process of planting. Loose, broken or manufactured balls will be rejected.

B. All plants materials in cans shall have been established in that can for a period of time not less than one (1) year, and shall be shown to be in a sound, healthy and vigorous state of growth. Plants not in such condition shall be rejected.

C. All plant material shall be planted immediately upon arrival on the premises if possible. If planting cannot be done immediately, the roots shall be protected from the sun and kept in a moist condition until the time of planting. Such protection may be provided by laying the plants on the north side of the building and covering the roots with wet straw.

D. If it is anticipated that planting will not be done for more than twenty-four (24) hours after the arrival of plants upon the premises, the bare root and ball and burlap stock shall be heeled-in on the north side of a building and all roots completely covered with dirt which shall be wetted down frequently. Care will be taken in the handling of all ball and burlap materials so that the earth around the roots is disturbed as little as possible.

3.4 **PLACEMENT OF PLANTS**

A. Plants shall be generally located as indicated by the drawing. The Contractor shall stake out the location of all plants and planting areas with identified plant stakes, and no excavation shall commence until such locations have been approved by the Landscape Architect. In the event that underground construction work or obstructions are encountered during excavation of the holes, alternate locations will be assigned and approved by the Landscape Architect.

3.5 **PLANT INSTALLATION**

A. All concrete work, sprinkling systems, and finished grading are to be completed and approved by the Landscape Architect or his representative before any planting of the specified plant materials is begun. No planting will be done without direct supervision of the Landscape Architect, or his representative.

B. No tree planting shall be initiated until sprinkling system is complete and tested. However, tree planting shall precede lawn planting.

C. All trees and shrubs shall be planted in pits as detailed in the planting details contained herein or as noted on the drawings. Tree and shrub pits in lawn areas shall be circular in outline, with a diameter at least three (3) feet greater than the diameter of the ball of each plant to be planted.

D. Plants in cans shall be planted in pits having a diameter at least three (3) feet greater than the diameter of the can from which the plant is taken. All plant pits shall be slightly less or equal in depth to the root ball. When the plant is properly placed in

the plant pit, the root collar shall be approximately one (1) inch above finished grade.

E. All subsoil excavated from tree and shrub pits shall be removed from the site.

F. The plant shall be set vertically in the plant pit, and backfill material carefully and firmly worked and tamped under and around the root system or ball to fill all voids. When partially backfilled and compacted, the burlap shall be removed from the sides of the root ball and the tops cut or adjusted to prevent the formation of air pockets. No burlap shall be pulled from under the root balls of the plants. The plants shall then be watered with a hose to completely soak the roots and backfilled with specified planting soil mixture.

G. The holes will then be completely backfilled and tamped well. A shallow basin or rain cup will be left around each plant. This basin will be equal in diameter to that of the original planting hole. Each plant will be placed in an individual hole. Holes which settle will be promptly filled with additional soil mixture at no additional expense to the owner.

H. A minimum of twelve (12) inches of topsoil is required in all planting beds. The Contractor will first use topsoil stockpiled on the site, and then furnish all additional topsoil as needed. Any topsoil furnished must meet the specifications stated in the planting notes shown on the construction drawings.

I. No trees will be planted closer than six (6) feet from any concrete walk or other paved surface except as approved by the Landscape Architect.

3.6 STAKING

A. All trees, including evergreen trees, shall be staked.

B. Staking shall be performed as follows:

1. Two (2) 2"x 2" wood stakes, eight (8) feet in length, will be used to support each tree planted under this contract unless otherwise indicated.
2. Tree ties shall conform to the staking detail shown on the planting detail sheet.
3. Each stake will be located six (6) to eight (8) inches away from the trunk and each opposing the other to provide maximum support to the trunk.
4. The stakes will be driven into the hole after the tree has been set-in, but before backfilling begins so as to avoid damage to the roots.

3.7 WATERING

A. All plants shall be thoroughly watered immediately after planting. This shall mean full and thorough saturation of all backfill in the pits and beds during the same day of planting. Water shall be applied only by open end hose at very low pressure to avoid air pockets, injury to the plant, or washing away of backfill. When planted, watered, and fully settled the plants shall be vertical and the stand shall be slightly above the stand in the nursery.

B. Supplemental Watering:

1. The Contractor shall hand water newly planted trees, twice a week for eight weeks.
2. A minimum of five (5) gallons per tree per watering required. Amount may vary pending seasonal rainfall.
3. The Contractor shall use a quick coupler and hose connected to the irrigation system to hand water the trees. Any other method must be approved by

Landscape Architect.

4. The Contractor must locate and stake any sprinkling head or valve box within 10' feet of proposed tree location, and must establish direction of lateral or main sprinkling line that serves the staked sprinkler head or valve box. This procedure will help eliminate hitting underground irrigation pipes.
5. The Contractor shall take extra care to watch for sprinkling heads and valve boxes in lawn area. Any broken sprinkling heads or valve boxes, etc., shall be replaced by Contractor at no expense to owner.

3.8 GRADES

A. Finished grade of topsoil and planting areas will be one and one-half (1 ½) inches below the top surface or finished grade of any paving, mowstrips, or walks adjacent to the planting area.

3.9 PRUNING

A. All plants shall be neatly pruned, after planting and inspection by the Landscape Architect, in accordance with the best horticultural practice. Broken or badly bruised branches shall be removed with a clean cut. Each plant shall be pruned to preserve its natural form and character, and in a manner appropriate to its particular requirements. In general, at least one-fourth (1/4) of the wood of deciduous shrubs shall be removed by thinning or shortening branches. Trees shall not be end pruned, but laterally thinned to preserve the natural character of the tree. All pruning shall be done by skilled men and with sharp tools. Pruning cuts over one-half (½) inch in diameter shall be painted with tree paint approved by the Landscape Architect.

3.10 CLEAN UP

A. Throughout the course of planting, excess and waste materials as well as excavated subsoil shall be continuously and promptly removed. All areas will be kept clear and all reasonable precautions taken to avoid damage to existing structures, plants, and grass. When planting in an area has been completed, the area shall be thoroughly cleaned of all debris, rubbish, subsoil, waste materials and removed from the property.

B. The ground surface shall be left in a condition satisfactory to the Landscape Architect or his representative.

3.11 REMOVAL OF STAKES

A. At the conclusion of the guarantee period and prior to final inspection by the Landscape Architect, of all planting, the Contractor shall be responsible for the removal of all tree stakes. This period of time shall be approximately 1 year after initial planting.

B. Stakes shall be removed by first cutting the ties securing the tree to stakes and secondly pulling stakes or guys out of the ground.

C. Stakes shall not be broken off above, at, or below ground levels but removed completely.

3.12 ESTABLISHMENT, MAINTENANCE, REPLACEMENT AND GUARANTEE

A. The Contractor shall be responsible for the proper care of all trees, shrubs, and ground covers during the period when these plants are becoming established.
B. All plants shall be kept in a healthy condition by any and all necessary operations of maintenance; to include but not be limited to, watering, weeding, pruning, spraying, adjusting of guys for the entire period of establishment.
C. The period of establishment shall begin at the time that the planting phase of the work is completed and shall continue for a minimum period of sixty (60) days from that date.
D. A one (1) year guarantee period shall begin at the end of the establishment period.
E. Plants which die or become unhealthy from any cause or appear to be in a badly impaired condition at any time during the guarantee period shall be removed promptly and replaced, and any plants that settle below or rise above the desired finished grades shall be reset at the proper grades.
F. All replacements shall be plants of the same kind, size, and quality as originally specified in the "plant list" and they shall be furnished, planted, staked, and maintained as specified herein at no additional cost.
G. The Contractor will not be responsible for plants destroyed or lost due to occupancy of the project or vandalism on the parts of others.
H. At the conclusion of the guarantee period a final inspection of all planting included in this contract will be made by the Landscape Architect. At that time any plant found to be not in a healthy growing condition, broken, damaged, or otherwise in such condition as to impair or destroy the symmetrical or other desired appearance as determined by the Landscape Architect shall be noted. Plants so noted shall be removed immediately from the site by the Contractor and replaced by him, as specified under this section with plants or like kind and size in the manner previously specified for the original planting without extra compensation.

3.13 PROTECTION OF EXISTING TREES

A. The Contractor shall be fully responsible for any damage to existing trees.
B. No pruning, thinning, or cutting will be allowed unless written permission is given by the Landscape Architect.
C. The Contractor shall replace with like kind and size any trees or existing shrubs by him or his sub-contractors.

3.14 MULCH REQUIREMENTS

A. Three (3) inches of mulch is required in shrub beds and over tree planting pits.

END OF SECTION

SECTION 02915

EARTHWORK

This specification adds a new section to the APWA Manual of Standard Specifications. All other provisions remain in full force and effect.

Add the following new section:

PART 1 GENERAL

1.1 **SUMMARY**

A. Section includes:

1. Excavation and backfill requirements

1.2 **REFERENCES**

A. Reference standards:

1. Compaction standard: Modified Proctor Density ASTM D 1557.

1.3 **SUBMITTALS**

A. Quality control submittals: Test reports of soils testing during construction specified under field quality control will be distributed by the testing laboratory.

1.4 **QUALITY ASSURANCE**

A. Testing agency: Soil testing during construction will be conducted by acceptable testing laboratory employed by the Contractor.

1.5 **PROJECT CONDITIONS**

A. Existing utilities: Protect sewer, water, gas, electric, phone and other pipe lines and conduits uncovered during work from damage until examined by Owner.

1. If such lines are found to be abandoned and not in use, remove without additional cost to Owner.
2. If such lines are found to be in use, carefully protect and carry on work around them. If Owner deems it advisable to move such lines, Owner will pay cost of moving.

1.6 **WARRANTY**

A. Fill and backfill: Correct settlement in backfill, fill, and in structures built over backfill or fill, which may occur within one year correction period. Restore structures damaged by settlement to original condition at no additional cost to Owner.

PART 2 PRODUCTS

2.1 **FILL AND BACKFILL MATERIAL**

A. TYPE A: Type A material shall be a clean gravel-sand mixture free from organic

matter and shall conform to the following gradation:

U.S. Standard Sieve Size	Percent by Weight Passing
1-inch	100
3/4-inch	90-100
No. 4	35-65
No. 16	15-40
No. 200	2-10

B. TYPE B: Type B material shall be a select granular material free from organic matter and of such size and gradation that the specified compaction can be readily attained. Material shall have a sand equivalent value of not less than 30 and shall conform to the following gradation:

U.S. Standard Sieve Size	Percent by Weight Passing
3/8-inch	100
No. 4	90-100
No. 50	10-40
No. 100	3-15
No. 200	0-7

C. TYPE C: Type C material shall be unclassified material and may be obtained from excavation on site. The material shall be free from peat, wood, roots, bark, debris, garbage, rubbish or other extraneous materials. The maximum size of stone shall not exceed 6 inches.

D. TYPE D: Type D material shall be crushed rock commonly known as drain rock and shall conform to the following gradation:

U.S Standard Sieve Size	Percent by Weight Passing
1-1/2-inch	100
3/4-inch	30-75
1/2-inch	15-55
1/4-inch	0-5
No. 200	0-2

Type D material shall be composed of hard, durable, sound pieces having a specific gravity of not less than 2.65.

E. TYPE E: Type E material shall be crushed rock and shall conform to the following gradation:

U.S. Standard Sieve Size	Percent by Weight Passing
1-1/2-inch	100
3/4-inch	81-91
1/2-inch	67-77
No. 4	43-53
No. 16	23-29
No. 200	6-10

Type E material shall be composed of hard, durable, sound pieces having a specific gravity of not less than 2.65.

2.2 **CLASSIFICATION OF FILL**

Fill material shall be placed in horizontal layers and compacted with power operated tampers, rollers, idlers, or vibratory equipment. Material type, maximum layer depth, relative compaction, and general application are specified in Table A. Unless otherwise specified, fill classes shall be used where specified in Table A under general application.

Table A - Fill Classifications

Material Type	Maximum Uncompressed Layer Depth, Inches	Minimum Relative Compaction, Percent	General Application
A	6	95	Under concrete sidewalks
B	8	95	Bedding for pipe, initial and subsequent pipeline backfill
C	8	95	Site fill, embankments, dikes, initial and subsequent pipeline backfill.
D	8	X	Fill under slabs and structures
E	12	95	Structural fill, fill under concrete walkways

Compaction of layers shall be accomplished in two passes of equipment with complete coverage across the width of the field.

PART 3 EXECUTION

3.1 **EXAMINATION**

A. Site Visit: Visit and inspect site. Take into consideration known and reasonably inferable conditions affecting work. Failure to visit site will not relieve Contractor of furnishing materials and performing work required.

3.2 **PREPARATION**

A. Field Survey: Visit and thoroughly inspect site for bench marks, monuments, batter boards, reference points, and layout and checking of work.

B. Protection

1. Maintain soil under foundation and slabs at natural moisture content.

2. Provide and maintain slopes, crowns and ditches to ensure satisfactory surface drainage at all times. Provide temporary drainage facilities to prevent water from draining into excavated areas. When work is completed, restore temporary ditches or cuts to original grade or finish grade as indicated.
3. Bailing or pumping: Immediately pump or bail water found in excavations, whether rain or seepage. Keep excavations free from water at all times. Take measures and furnish equipment and labor necessary to control flow, drainage, and accumulation of water as required to permit completion of work under this section and to avoid damage to work.

3.3 EXCAVATION

A. General: Excavate sites as required for walls, foundations, piers, area pits, etc., to depths indicated on drawings.
   1. Trench bottoms: Provide full width required. If through error, trenches are carried deeper than required, fill excess depth with compacted fill or concrete as directed at Contractor's expense.
   2. Remove loose material from bottom of excavation by hand.
   3. If debris, soft sports, or excessively moist areas are found at bottom of any excavation, immediately report condition to Project Manager/Engineer who will determine if corrective work is necessary.

B. Unclassified excavation: All excavation (other than rock excavation) is considered as unclassified and is defined as removal of all material encountered, regardless of soil type. Unclassified excavation is considered normal excavation and no extra costs will be paid by Owner.

3.4 PREPARATION OF NATURAL GROUND

A. General: Remove topsoil and vegetation before beginning preparation of natural ground. Remove frozen or muddy ground in fill areas.

B. Fills made on hillsides of slopes: Plow scarify slope of original ground upon which fill is to be placed. Where slope ratio of original ground is steeper than 5 horizontal to 1 vertical, step or bench bank.

C. Preparation: Mix and blend plowed and scarified surface with disc or grader blade so surface will be free of large clods and rocks, ruts, hummocks and other uneven features which would tend to prevent uniform compaction by equipment to be used.

D. Scarification and compaction: Natural ground under fill areas below interior floor slabs and exterior paving shall be scarified to minimum depth of 6 inches and recompacted at near optimum moisture content to at least 90 percent of its relative Proctor density per ASTM D1557.

E. Subgrade below areas to be filled: Proofroll with heavy pneumatic-tired vehicle, such as loaded ten wheel dump truck. Excavate and recompact areas which deform excessively.

3.5 FILLING AND COMPACTION

A. General: Fill and compact to levels required to complete work indicated. Filling may require material in excess of quantity of suitable soils material available from required grading and excavations even though not indicated on drawings.

B. Placing fill: Distribute material to avoid formation of lenses or layers of material

differing substantially from surrounding material.

1. Avoid unnecessary concentration of travel causing ruts and uneven compaction. Regrade and compact ruts and hollows more than 6 inches deep before compacting.
2. Spread fill material in uniform horizontal layers no greater than 8 inches thick.

C. Backfilling: Fill and compact temporary holes and excavation around interior walls, grade beams, piers, trenches, on inside of building and excavation around exterior foundation walls.

1. Verify waterproofing and damp-proofing have been inspected and protected before backfilling.
2. Backfill in even lifts on both sides of foundation walls to prevent excessive pressure on backfilling and leave bracing in place until supporting floors are in place.
3. Debris, construction materials, expansible clay, or large hard clods of earth are not allowed in backfill.
4. Obtain permission before backfilling.
5. Backfill and mechanically compact as indicated before. Puddling is not allowed.

D. Compaction of cohesive materials: When moisture content and condition of each spread layer is satisfactory, compact to densities specified below.

1. Fill material shall have moisture content near optimum at time of compaction.
2. Four to eight passes of sheepsfoot roller are suggested for first trial. Feet of roller shall extend approximately 8 inches in clear projection from roller's cylindrical surface and shall be spaced to provide roller with cleaner bars designed and attached to prevent accumulation of material between tamper feet.

E. Compaction of cohesionless materials: When compacting material, such as sands and gravels, deposit materials in layers and compact by treads of crawler type tractors, surface or internal vibrators, smooth or pneumatic rollers, hand or power tampers.

1. Thickness of horizontal layers after deposition shall be not more than 6 inches if compaction if performed by tractor treads, surface vibrators, or similar equipment. If compaction is performed by internal vibrators, thickness of horizontal layers after compaction shall be not more than penetrating length of vibrator head.
2. Ponding or water flooding not allowed.

F. Compaction requirements: Compact each layer by methods acceptable to Geotechnical Engineer with ±2 percent of optimum moisture content to minimum relative Proctor densities as determined by ASTM D1557. The following percentages shall serve as a guideline in the areas listed:

1. Structures, Building Slabs and Steps, Curb and Gutter, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 95% of maximum dry density (relative compaction) or 75% relative density as applicable.
2. Lawn or Unpaved Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85% of maximum dry density (relative compaction) or 65% relative density as applicable.
3. Sidewalks: Compact top 6 inches of subgrade and each layer of backfill or fill

material to 95% of maximum dry density (relative compaction).

4. Roadways: See Sections 02510 and 02520.

3.6 **EXCESS OR UNUSABLE MATERIAL**

A. Excess material: Remove from site.

3.7 **UNDERSLAB GRAVEL**

A. Gravel: Place, spread and compact lift of underslab gravel to 95 percent Standard Proctor density to thickness indicated. Level and re-compact if necessary immediately prior to placing concrete.

3.8 **FINISH GRADING**

A. General: Cut and fill areas to elevations and tolerances specified. Leave graded surface clean, free from rubbish and large clods and reasonably smooth.

B. Contaminated Material: Do not use earth that has been rendered unfit to receive planting due to having concrete water or mortar or lime water dumped on it.

C. Subgrade under sidewalk, curb, gutter, and slabs-on-grade: Finish grade to bearing surface. Tolerance: $\pm$0.05 foot.

D. Subgrade under paving: Finish grade to bottom elevation of aggregate base course. Tolerance: $\pm$0.05 foot.

E. Subgrade under sodded areas: Finish grade to elevations allowing for 1-1/2 inches of sod, maintaining top of sod at elevations indicated. Tolerance: $\pm$0.1 foot.

3.9 **UNSUITABLE BEARING MATERIAL**

A. Pocket of soft or expansive material or debris: If such pockets are found, Geotechnical Engineer may order them removed and replaced with compacted earth fill.

1. Fill material: On-site or imported material as provided paragraph 02200-2.2.
2. Work will be covered by change order.

3.10 **FIELD QUALITY CONTROL**

A. Placement method: Contractor's option, adequate to achieve required moisture content and density.

B. Compaction: Sufficient tests will be made to assure compliance with these specifications. If because of unsatisfactory test results it is necessary to retest after corrective work, cost of all compaction tests shall be paid by Contractor.

C. Density tests: In accordance with ASTM D1556, ASTM D2922, or ASTM D2167.

END OF SECTION

SECTION 02930

GROUNDCOVER

This specification changes a portion of APWA Standard Specification Section 02930. All other provisions of the section remain in full force and effect.

Delete Article 1.7 A, 3.3 D, and replace with the following:

1.7 **GUARANTEE**

A. All shrubs and ground covers shall be guaranteed by the contractor as to growth and health for a period of sixty (60) after completion of the maintenance period and final acceptance.

B. The contractor, within fifteen (15) days after receiving written notification by the project engineer, shall remove and replace all guaranteed plant materials which for any reason fail to meet the requirements of the guarantee. Replacement shall be made with plant materials as indicated or specified on the original plans, and all such replacement materials shall be guaranteed as specified for the original materials.

3.3 **INSTALLATION**

D. Establish finish grades in all planting beds two (2) inches below all walks, hard surfaces, and edgers. Provide adequate drainage so no water pockets or ridges are created after settling. Planting mix to be used shall consist of 100% topsoil (either existing or imported).

END OF SECTION

SECTION 02932

TREE

This specification changes a portion of APWA Manual of Standard Specifications Section 02932. All other provisions of the section remain in full force and effect.

Delete Articles 2.2 A; 3.3 F, G; replace with the following:

2.2 **SOILS**

A. Backfill mix shall consist of 100% topsoil (either existing or imported).

3.3 **INSTALLATION**

F. Where indicated install 3 inch layer of shredded bark mulch in 3 feet radius around tree trunk.

G. Stake all deciduous trees per tree staking detail on plans.

3.8 **STAKING**

A. Stake all deciduous trees per tree staking detail on plans.

B. Vinyl tree ties shall be used to secure trees to stakes. Wire and rubber hose shall not be acceptable. Use appropriate sized vinyl tie.

C. For all trees located in turf areas, construct a 3' radius circle around each tree, in which all grass and other plant material has been removed. Place a 3" layer of shredded bark mulch in the cleared area. Finish grade of mulch layer shall be 1" below finish grade of grass.

END OF SECTION

SECTION 02935

PLANT MAINTENANCE

This specification changes a portion of APWA Manual of Standard Specifications Section 02935. All other provisions of the section remain in full force and effect.

Delete Article 1.02 C and D, Article 1.6 A and B; replace with the following:

1.2 **GRASS MAINTENANCE**

C. Fertilizing: Fertilize as directed in notes using specified fertilizers and rates.

D. Mowing: Cut grass for the first time when it reaches a height of 3 inches and maintain to minimum height of 2 inches. Do not cut more than 1/3 of blade at any one mowing. Remove clippings. After first mowing, water to moisten soil from 3 inches to 5 inches deep. Allow a minimum of 5 to 7 days between mowings.

1.6 **GUARANTEE**

A. All shrubs and groundcovers shall be guaranteed by the contractor as to growth and health for a period of sixty (60) after completion of the maintenance period and final acceptance. All trees shall be guaranteed by the contractor to live and grow in an acceptable upright position for a period of one (1) year after completion of the specified maintenance period and final acceptance.

B. The contractor, within fifteen (15) days after receiving written notification by the project engineer, shall remove and replace all guaranteed plant materials which for any reason fail to meet the requirements of the guarantee. Replacement shall be made with plant materials as indicated or specified on the original plans, and all such replacement materials shall be guaranteed as specified for the original materials.

END OF SECTION

SECTION 03060

EXPANSION AND CONTRACTION JOINTS

This specification is from the APWA Manual of Standard Specifications, 2002 Edition. All other provisions remain in full force and effect.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Joints and joint sealants in horizontal traffic surfaces for cast-in-place concrete sidewalks, curb, gutter and pavement slabs.

1.2 REFERENCES

A. ASTM C 920: Standard Specification for Elastomeric Joint Sealants.
B. ASTM D 545: Standard Methods of Testing Preformed Expansion Joint Fillers for Concrete Construction (Non-extruding and Resilient Types).
C. ASTM D 994: Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
D. ASTM D 1190: Standard Specification for Concrete Joint Sealer, Hot-Poured Elastic Type.
E. ASTM D 1191: Standard Method for Testing Concrete Joint Sealers.
F. ASTM D 1751: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
G. ASTM D 1752: Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
H. ASTM D 1850: Standard Specification for Concrete Joint Sealer, Cold-Application Type.
I. ASTM D 1851: Standard Methods of Testing Concrete Joint Sealers, Cold-Application Type.
J. ASTM D 2240: Standard Test Method for Rubber Property - Durometer Hardness.
K. ASTM D 2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
L. ASTM D 3405: Standard Specification for Joint Sealants, Hot-Poured, For Concrete and Asphalt Pavements.
M. ASTM D 3406: Standard Specification for Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements.
N. ASTM D 3407: Standard Methods of Testing Joint Sealants, Hot-Poured, For Concrete and Asphalt Pavements.
O. ASTM D 3408: Standard Methods of Testing Joint Sealants, Hot-Poured, Elastomeric-Type, for Portland Cement Concrete Pavements.
P. ASTM D 3542: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Bridges.
Q. ASTM D 3569: Standard Specification for Joint, Sealant, Hot-Applied, Elastomeric, Jet-Fuel-Resistant-Type for Portland Cement Concrete Pavements.

R. ASTM D 3575: Standard Test Method for Flexible Cellular Materials Made from Olefin Polymers.

S. ASTM D 3581: Standard Specification for Joint Sealant, Hot-Poured, Jet-Fuel-Resistant Type, for Portland Cement Concrete and Tar-Concrete Pavements.

T. ASTM D 3582: Standard Methods for Testing Joint Sealant, Hot-Poured, Jet-Fuel-Resistant Type, for Portland Cement Concrete and Tar-Concrete Pavements.

U. ASTM D 3583: Standard Methods of Testing Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements, or Joint Sealant, Hot-Applied, Elastomeric, Jet-Fuel-Resistant-Type, for Portland Cement Concrete Pavements.

V. ASTM D 5249: Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement and Asphalt Joints.

W. ASTM D 5893: Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

X. FS SS-S-200: Sealants, Joint, Two Component, Jet-Fuel Resistant, Cold-Applied, for Portland Cement Concrete Pavement.

1.3 SYSTEM PERFORMANCES

A. Pavement joints include longitudinal and transverse expansion joints, contraction joints, construction joints, and crack control joints.

B. Provide joint sealants that maintain watertight and airtight continuous seals.

1.4 SUBMITTALS

A. Manufacturer's certification that product was manufactured, tested and supplied per source quality control requirements specified herein, together with a report of the test results and the date each test was completed.

B. Manufacturer's instruction for joint preparation, type of cleaning and installation.

C. Manufacturer's Product Data and Samples for each joint sealant product required.

D. Safety data sheets.

1.5 QUALITY ASSURANCE

A. Installation of joint systems shall follow manufacturer's published directions.

B. For cold applied joint sealant installation, use installers approved by the joint sealant supplier.

C. Obtain joint sealing materials from a single manufacturer for each different product required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in original unopened containers or bundles with labels identifying manufacturer, product name and designation, color, expiration period for use, pot life, cure time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations

to prevent deterioration; or damage due to moisture, high or low temperatures, contaminants.

PART 2 PRODUCTS

2.1 GENERAL

A. Compatibility: Provide joint fillers, sealant backings, sealants, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2.2 JOINT VOID - FORMER

A. Plastic with a water stop.
B. 1/4 depth of concrete structural section.

2.3 JOINT FILLER - SHEET TYPE

A. F-1: Bituminous (asphalt or tar) mastic per ASTM D 994; formed and encased between 2 layers of bituminous saturated felt or 2 layers of glass-fiber felt.
B. F-2: Cane or other cellulosic fiber per ASTM D 1751; saturated with asphalt.
C. F-3: Granulated cork per ASTM D 1751; in an asphalt binder; encased between 2 layers of asphalt saturated felt or 2 layers of glass-fiber felt.
D. F-4: Sponge rubber fully compressible per ASTM C 1752; with resiliency recovery rate of 90-percent minimum.
E. F-5: Cork per ASTM C 1752; impregnated and bound with asphalt; compressible with resiliency recovery rate of 90-percent if not compressed more than 50-percent of original thickness
F. F-6: Plastic foam (for cold-applied sealants only) preformed, compressible, resilient, non-waxing, non-extruding strips of flexible, non-gassing plastic foam; non-absorbent to water and gas; 30 lb/ffi density maximum; and of size and shape to control sealant depth and performance.

2.4 JOINT FILLER - BACKER ROD, TAPE, POURED FILL TYPE

A. Backer material per ASTM D 5249 for cold- and hot-applied joint sealant in Portland cement concrete or asphalt pavements joints.
B. Type 1: Round rods.
C. Type 2: Sheets or strips, laminated or skived.
D. Type 3: Poured fills which completely fill pavement joint.

2.5 JOINT SEALANT - GENERAL

A. Color of exposed joint sealant indicated, or if not, as selected from manufacturer's standard colors.

2.6 JOINT SEALANT - HOT-APPLIED

A. HAS-1: Asphalt base type per ASTM D 3405.
B. HAS-2: Thermoplastic type per ASTM D 3581; jet-fuel resistant without rubber unless indicated otherwise.
C. HAS-3: Elastic type per ASTM D 1190.

D. HAS-4: Elastomeric type per ASTM D 3406; one component, for Portland cement concrete pavements.
E. HAS-5: Elastomeric type per ASTM D 3569; one component, jet-fuel resistant, for Portland cement concrete pavements.

2.7 **JOINT SEALANT - COLD-APPLIED**

A. CAS-1: Elastomeric type per ASTM C 920; chemically curing, for vehicular or pedestrian use, and types of construction other than highway and airfield pavements and bridges and joint substrates indicated; Type S or M; Grade P or NS; Class 25; Use T, NT, M and O.
   1. Self leveling.
   2. Shore A Hardness: 40 ± 5 ASTM D 2240.
   3. Final cure: 4 days maximum.
   4. Service range: -10 to 150 deg. F.
B. CAS-2: Mastic type; single or multiple component; for joints having a minimum width of 1/2-inch; ASTM D 1850
C. CAS-3: Coal-tar modified urethane one part, jet fuel resistant; Type H per FS SS-S-200;
D. CAS-4: Elastomeric preformed polychloroprene type with lubricant adhesive and indicated movement ratio.
   1. For concrete pavement seal; ASTM D 2628.
   2. For concrete bridge seals; ASTM D 3542.
E. CAS-5: Silicone type, single component, non-sag or self leveling, chemically curing sealant based on polymers of polysiloxane structure intended for use in Portland cement concrete pavements; ASTM D 5893.
F. CAS-6: Asphalt base meeting ASTM D 3405.
G. CAS-7: Olefin polymer per ASTM D 3575 as follows.
   1. Tensile elongation 255% ± 20% per Suffix T.
   2. Tensile strength 115 psi minimum per Suffix T
   3. Density 2.9 ± 3 lbs/cf per Suffix W, Method A
   4. Water Absorption 0.025 lbs/sf maximum per Suffix L.

2.8 **SOURCE QUALITY CONTROL**

A. Preformed Expansion Joint Fillers: Non-extruding and resilient types; ASTM D 545.
B. Hot-Applied Joint Sealants:
   1. Elastic type used in concrete pavements, bridges, other structures; ASTM D 1191.
   2. Bituminous type for hydraulic and asphaltic concrete pavements; ASTM D 3407.
   3. Elastomeric type for hydraulic concrete pavement; ASTM D 3408.
C. Jet-Fuel-Resistant Joint Sealant: Hot-applied; ASTM D 3582 and ASTM D 3583.
D. Cold-Applied Mastic Joint Sealant: Cold-applied per ASTM D 1851.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove oil, grease, wax, form-release-agents, curing compounds, bitumens, laitance and old chalking material by sandblast, or water blast as recommended by manufacturer of sealant. Maximum sand blast angle, 25 degrees ±5.
B. Clean and dry with air blast. Do not contaminate air blast with oils or lubricants.
C. Remove frost and moisture in concrete joint substrates before commencing sealing.
D. Install bond breaker tape where needed or required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

3.2 JOINT SEALING

A. General:
   1. Install sealants in uniform, continuous ribbons without gaps or air pockets, with complete bonding of joint surfaces on opposite sides.
   2. Except as otherwise indicated, fill sealant rabbet flush with surface.
   3. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove so that joint will not trap moisture and dirt.
B. Depths: Saw cut joints if necessary to provide the required sealant thickness and depth. Install sealant to depths indicated or, if not indicated, as recommended by sealant manufacturer, but within the following general limitations measured at center (thin) section of bead:
   1. For sidewalks, pavements, and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but not more than 5/8-inch deep nor less than 3/8-inch deep.
   2. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2-inch deep nor less than 1/4-inch deep.
   3. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints full depth.
C. Spillage: Do not allow poured sealant compound to overflow or spill onto adjoining surfaces or to migrate into voids of adjoining surfaces. Clean adjoining surfaces to eliminate evidence of spillage.
D. Heating: Do not use overheated hot-applied sealants.
E. Edges: Unless indicated otherwise, recess exposed edges of gasket and exposed joint fillers slightly behind adjoining surfaces so compressed units will not protrude from joints.

3.3 CURING AND CLEANING

A. Cure sealants and caulking compounds per manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.
B. Clean off excess sealants or sealant smears adjacent to joints as work progresses. Use methods and cleaning materials approved by manufacturers of joint sealant and of products in which joints occur.
C. Remove protective coating and oil from metals with solvent recommended by the sealant manufacturer.

3.4 **PROTECTION**

A. Protect joint sealant during and after curing period from contact with contaminating substances or from damage resulting from deterioration or damage at time of Substantial Completion.

B. If damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealant immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work at no additional cost to OWNER.

END OF SECTION

SECTION 03100

FORMWORK

This specification is from the APWA Manual of Standard Specifications, 2002 Edition. All other provisions remain in full force and effect.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in-place concrete.
B. Openings in formwork for other affected work.
C. Form accessories such as snap ties, bracing, etc.
D. Stripping formwork.

1.2 REFERENCES

A. ACI 347: Recommended Practice for Concrete Formwork.

1.3 DEFINITIONS

A. Shoring: The activity to support formwork.
B. Reshoring: The activity to reduce the amount of formwork supporting concrete elements. As concrete sets and strength increases, less need for formwork occurs gradually until concrete becomes free standing.

1.4 SUBMITTALS

A. Shop Drawings: Fabrication and erection drawings of forms for specific finished concrete surfaces, as indicated. Show general construction of forms, jointing, special joints or reveals, location and pattern of form tie placement, and other items affecting exposed concrete visibility.
B. Form Release Agent: Where concrete surfaces are scheduled to receive special finishes or applied coverings which may be affected by agent submit manufacturer's instructions for use of agent.

1.5 QUALITY ASSURANCE

A. Designer's Qualifications: Structural professional engineer who complies with Utah licensing law, has experience in concrete formwork, and is acceptable to the authority having jurisdiction.
B. Design Forms:
    1. With sufficient strength to maintain finished tolerances indicated in Section 03350, to support loads, pressures, and allowable stresses as outlined in ACI 347 and for design considerations such as wind loads, allowable stresses, and other applicable requirements of local Laws and Regulations.
    2. To permit easy removal.
    3. For required finishes.
C. The design, engineering, and construction of formwork is CONTRACTOR's responsibility.

1.6 **JOB CONDITIONS**

A. For reference purposes, establish and maintain sufficient control points and bench marks to check tolerances. Maintain in an undisturbed condition and until final completion and acceptance of Work.

B. Regardless of tolerances specified, allow no portion of Work to extend beyond legal boundaries.

1.7 **FIELD SAMPLES**

A. Prepare field samples and submit per Section 01330.

B. Construct and erect sample formwork panel for architectural concrete surfaces receiving special treatment or finish as a result of formwork. Formwork to include vertical and horizontal form joints and typical rustication joints when required.

C. Size panel to indicate special treatment or finish required, including form release agent.

D. Remove formwork after casting concrete.

1.8 **ACCEPTANCE**

A. Secure ENGINEER's approval of forms for concrete flat work.

PART 2 PRODUCTS

2.1 **FORM MATERIALS**

A. Faced with material which will produce smooth and uniform texture on concrete, unless indicated otherwise.

B. Arrange facing material orderly and symmetrical, keeping number of seams to a minimum.

C. Do not use material with raised grain, patches, or other defects which will impair texture of concrete surface.

2.2 **FORMWORK ACCESSORIES**

A. Form Ties:

1. Use ties constructed so that end fasteners can be removed without sinning concrete faces.
2. After end fasteners of ties have been removed, embedded portion of ties are to terminate not less than 2 times the diameter or thickness of the fasteners from formed faces of concrete, but in no case greater than 3/4-inch.
3. When the formed face on concrete is not exposed, form ties may be cut off flush with formed surfaces. Use ties with ¾ inch diameter cones on both ends or an approved equal for water retaining structures.

B. Pre-molded Expansion Joint Filler: Unless indicated otherwise, provide Type F1 per Section 03060.

C. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, impair natural bonding or color characteristics of concrete. To prevent contamination, agents used on potable water structures are subject to review by ENGINEER prior to use.

D. Fillets for Chamfered Corners: Wood strips 1-inch x 1-inch size; maximum possible length.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify lines, levels, and measurements before proceeding with formwork.

3.2 FORM CONSTRUCTION

A. Make forms sufficiently tight to prevent loss of concrete.
B. Unless indicated otherwise, place chamfer strips in corners of forms to produce beveled edges on permanently exposed exterior corners.
C. To maintain specified finish tolerances, camber formwork to compensate for anticipated deflections.
D. Provide positive means of adjustment using wedges, jacks, Shores, and struts to take up all settlement during concrete placing operation.
E. Provide temporary ports in formwork to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
F. At construction joints, overlap forms over hardened concrete at least 6-inches. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain true surface.
G. Construct wood forms for wall openings to facilitate loosening, or counteract swelling.
H. Fasten wedges used for final adjustment of forms prior to concrete placement in position after final check.
I. Anchor formwork to Shores, supporting surfaces or members to prevent upward or lateral movement and deflection of any part of formwork system during concrete placement.
J. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing.
K. Position expansion joint material and other embedded items accurately and support to prevent displacement.
L. To prevent entry of concrete, fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material.
M. For architectural concrete, limit deflection of facing materials between studs as well as deflection of studs and walers to 0.0025 times span.
N. For underground concrete work, do not use soil walls for forming unless authorized by ENGINEER.

3.3 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings for elements embedded in or passing through concrete.
B. Coordinate work of other sections for the forming and setting of openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.
C. Install accessories per manufacturer's instructions. Ensure items are not disturbed during concrete placement.

3.4 FORM FINISHES

A. Use forms with smooth rubbed, scrubbed, sand floated finishes that meet ACI 347 unless indicated otherwise.
B. For As-cast Finishes:
   1. Install form panels in orderly arrangement with joints planned in approved relation to building elements.
   2. Where panel joints are recessed or otherwise emphasized, locate form ties within joints, not within panel areas.
   3. Where an as-cast finish is required, no grouting will be permitted in the finishing operation.
C. Textured Finishes: As indicated.

3.5 APPLICATION OF FORM RELEASE AGENT

A. Apply form release agent on formwork per manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

3.6 FORM REMOVAL

A. Do not pry against face of concrete. Use only wooden wedges.
B. When repair of surface defects or finishing is required at an early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations.
C. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging. Perform needed repairs or treatment required on such sloping surfaces at once, followed by specified curing.
D. Loosen wood forms for wall openings as soon as it can be accomplished without damage to concrete.
E. Formwork for columns, walls, sides of beams, and other members not supporting the weight of concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal.
F. Where no Reshoring is planned, leave forms and Shoring used to support weight of concrete in beams, slabs, and other concrete members in place until concrete has attained its specified strength.
G. Where Reshoring is planned, supporting formwork may be removed when concrete has reached 70-percent of specified strength, provided Reshoring is installed immediately.
H. When Shores and other vertical supports are so arranged that nonload carrying, form-facing material may be removed without loosening or disturbing Shores and supports, facing material may be removed at an earlier age as directed.

3.7 RESHORING

A. When Reshoring is permitted or required, plan operations in advance and obtain approval.
B. During Reshoring do not subject concrete in beam, slab, column, or any other structural member to combined dead and construction loads and live loads in excess of loads permitted for developed concrete strength at time of Reshoring.
C. Place Reshores as soon as practical after stripping operations are complete, but in no case later than end of working day on which stripping occurs.
D. Tighten Reshores to carry required loads without over-stressing.

E. Leave Reshores in place until the concrete being supported has reached its specified strength.

F. For floors supporting Shores under newly placed concrete, level original supporting Shore or Reshore.
   1. Reshoring system shall have a capacity to resist anticipated loads in all cases equal to at least 1/2 the capacity of the Shoring system.
   2. Unless otherwise specified locate Reshores directly under a Shore.
   3. In multistory buildings, extend Reshoring through a sufficient number of stories to distribute the weight of newly placed concrete, forms, and construction live loads in such a manner that design loads of floors and supporting Shores are not exceeded.

G. Design, engineering, and construction of Shoring and Reshoring is the responsibility of the CONTRACTOR.

3.8 REMOVAL STRENGTH

A When removal of formwork or Reshoring is based on concrete reaching a specified strength, it shall be assumed that concrete has reached this strength when either of the following conditions has been met:
   1. When test cylinders, field cured along with the concrete they represent, have reached the specified strength.
   2. When concrete has been cured per Section 03390 for the same length of time as the site-cured cylinders that reached specified strength. Determine the length of time the concrete has been cured in the structure by cumulative number of days or fractions thereof, not necessarily consecutive, during which the air temperature is above 50 deg. F. and concrete has been damp or sealed from evaporation and loss of moisture.

3.9 REUSE OF FORMS

A. Do not reuse forms if there is any evidence of surface wear or defect which would impair quality of concrete surface.

B. Thoroughly clean and properly coat forms before reuse.

3.10 FIELD QUALITY CONTROL

A. Before commencing a pour, verify connections, form alignment, ties, inserts and Shoring are placed and secure.

B. Observe formwork continuously while concrete is being placed to verify that the forms are plumb and there are no deviations from desired elevation, alignment, or camber.

C. If during construction any weakness develops and false-work shows undue settlement or discoloration, stop work, remove affected construction if permanently damaged, and strengthen false-work.

END OF SECTION

SECTION 03200

REINFORCEMENT

This specification is from the APWA Manual of Standard Specifications, 2002 Edition. All other provisions remain in full force and effect.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reinforcing steel bars, wire fabric or rod mats for cast-in-place concrete.
B. Support chairs, bolsters, bar supports, and spacers for supporting reinforcement.

1.2 REFERENCES

A. AASHTO M 254: Standard Specification for Corrosion Resistant Coated Dowel Bars.
B. ACI 301: Specifications for Structural Concrete for Buildings.
C. ACI 315: Details and Detailing of Concrete Reinforcement.
D. ASTM A 82: Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
E. ASTM A 185: Standard Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
F. ASTM A 615: Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
G. ASTM A 706: Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
H. ASTM C 1116: Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
I. ASTM D 3963: Standard Specification for Epoxy-Coated Reinforcing Steel.
J. AWS D1.1: Structural Welding Code Steel.
K. AWS D1.4: Structural Welding Code Reinforcing Steel.
L. CRSI Document: Manual of Standard Practice.

1.3 SUBMITTALS

A. Manufacturer's Certificate: Submit mill test certificates of supplied concrete reinforcement, indicating physical and chemical analysis.
B. Welder's certification.
C. Shop Drawings:
    1. Indicate sizes, spacings, locations, and quantities of reinforcing steel, wire fabric, bending and cutting schedules, splicing, stirrup spacing, supporting, and spacing devices.
    2. When required, prepare shop drawings by an engineer who complies with Utah licensing law and is acceptable to agency having jurisdiction.

1.4 QUALITY ASSURANCE

A. Perform concrete reinforcement work per CAST Manual of Standard Practice.

B. Comply with ACI 301.
C. Welders: AWS D1.1 or AWS D1.4 as applicable.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fiber Reinforcement: ASTM C 1116 glass.
B. Reinforcing Steel: Deformed 60 ksi yield grade steel per ASTM A 615 and supplementary requirements S l or ASTM A 706 for welding.
C. Welded Steel Wire Fabric: ASTM A 185 plain type in flat sheets or coiled rolls. Dimensions of the mesh 4"x 4" or as indicated.
D. Stirrups: ASTM A 82 steel.
E. Plain Dowel Bars for Expansion Joints: Smooth grade 60 ksi yield grade steel per ASTM A 615,
    1. Galvanized or epoxy coated in roadway pavements.
    2. Provide metal dowel cap at one end of dowel to permit longitudinal movement of dowel within concrete section. Design caps with 1 end closed.
    3. Provide for movement equal to joint width plus 1/2-inch.
    4. For load transfer bars, paint with 1 coat of paint conforming to AASHTO M 254 and coat 1/2 with grease.
F. Coatings for Corrosion Protection:
    1. Epoxy coat per ASTM D 3963.
    2. Galvanized per Section 05070.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16 gage annealed type or an acceptable patented system.
B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

2.3 FABRICATION

A. Fabricate reinforcement per ACI 315 providing for concrete cover.
B. Locate reinforcing splices not indicated on drawings at points of minimum stress. Indicate location of splices on shop drawings.
C. Weld reinforcing bars per with AWS D1.4.

PART 3 EXECUTION

3.1 PLACING

A. All reinforcement to be free of loose mill scale, loose or thick rust, dirt, paint, oil or grease.
B. Place all reinforcement in the exact position indicated. With tie wire, tie bars together at all intersections except where spacing is less than 12-inches in each direction, in which case tie alternate intersections.
C. Maintain the distance from vertical forms and between layers of reinforcement by

means of prefabricated chairs, ties, hangers, or other approved devices. Placing and fastening of reinforcement in each section of the Work must be approved before concrete is placed.

D. Overlap sheets of metal mesh one square plus 6-inches to maintain a uniform strength. Securely fasten at the ends, edges, and supports to maintain clearances.

E. Flat Slab Work:
   1. Support reinforcing steel of formed flat slabs with metal chairs, precast concrete blocks or other slab bolsters.
   2. Size chairs or bolsters to position the steel in the exact location indicated.
   3. Space chairs for supporting the top steel and bolsters for supporting the bottom steel not more than 5-feet on centers in each direction.
   4. Plastic or epoxy coat that portion of the metal support in contact with the forms to prevent rust.
   5. Tie down deck steel to beams or forms at regular intervals of not more than 5-feet on centers along the beams or forms to prevent movement of the steel during concrete placement.

3.2 SPLICING

A. Furnish all reinforcement in the full lengths indicated unless otherwise permitted. Splicing of bars, except where indicated is not permitted without written approval. Stagger splices where possible.

B. Unless indicated otherwise, overlap reinforcing bars a minimum of 30 diameters to make the splice. In lapped splices, place the bars and wire to maintain the minimum distance for clear spacing to the surface of the concrete.

C. Do not use lap splices on bars greater in diameter than No. 11 unless approved.

D. Weld reinforcing steel only if indicated or if authorized in writing. Weld in conformance to AWS D1.4.

E. Do not bend reinforcement after embedding in hardened concrete.

F. Do not permit reinforcement or other embedded metal items bonded to the concrete, to extend continuously through any expansion joint, except dowels in floors bonded on only one side of joints.

3.3 PLACING EMBEDDED ITEMS

A. Place all sleeves, inserts, anchors and embedded items prior to concrete placement. Temporarily fill voids in embedded items to prevent entry of concrete.

B. Give all trades whose work is related to the concrete section ample notice and opportunity to introduce or furnish embedded items before concrete placement.

END OF SECTION

SECTION 03304

CAST-IN-PLACE CONCRETE

This specification is from the APWA Manual of Standard Specifications, 2002 Edition. All other provisions remain in full force and effect.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cast-in-place concrete material requirements.

1.2 REFERENCES

A. AASHTO T 26: Standard Method of Test for Quality of Water to be Used in Concrete.
B. ACI 211.1: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
C. ACI 211.2: Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
D. ACI 211.3: Standard Practice for Selecting Proportions for No-Slump Concrete.
E. ACI 214: Recommended Practice for Evaluation of Strength Test Results of Concrete.
F. ACI 301: Specifications for Structural Concrete for Buildings.
G. ACI 305R: Hot Weather Concreting.
H. ACI 306R: Cold Weather Concreting.
I. ACI 318: Building Code Requirements for Reinforced Concrete.
J. ASTM C 33: Standard Specification for Concrete Aggregates.
K. ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
L. ASTM C 78: Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
M. ASTM C 88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
N. ASTM C 94: Standard Specification for Ready-Mixed Concrete.
O. ASTM C 131: Standard Test Method for Resistance to Degradation of Small-size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
P. ASTM C 150: Standard Specification for Portland Cement.
Q. ASTM C 227: Standard Test Method for Potential Reactivity of Cement-Aggregate Combinations (Mortar Bar Method).
R. ASTM C 231: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
S. ASTM C 260: Standard Specification for Air-Entraining Admixtures for Concrete.
T. ASTM C 289: Standard Test Method for Potential Reactivity of Aggregates (Chemical Method).
U. ASTM C 295: Standard Practice for Petrographic Examination of Aggregates for Concrete.

V. ASTM C 441: Standard Test Method for Effectiveness of Mineral Admixtures or Ground Blast-Furnace Slag in Preventing Excessive Expansion of Concrete Due to The Alkali-Silica Reaction.
W. ASTM C 494: Standard Specification for Chemical Admixtures for Concrete.
X. ASTM C 595: Standard Specification for Blended Hydraulic Cements.
Y. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
Z. ASTM C 1116: Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
AA. ASTM C 1157: Standard Performance Specification for Blended Hydraulic Cement.
BB. ASTM C 1240: Standard Specification for Use of Silica Fume as a Mineral Admixture in Hydraulic Cement Concrete, Mortar, and Grout.
CC. ASTM C 1260: Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
DD. ASTM C 1293: Standard Test Method for Concrete Aggregates by Determination of Length Change of Concrete Due to AlkaliSilica Reaction.
EE. ASTM D 1077: Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
FF. ASTM STP 15-C: Manual on Quality Control of Materials.

1.3 **DEFINITIONS**

A. Average Strength (F_{cr}) The required average strength for 30 consecutive strength tests which statistically assures no more than 1 test in 100 tests will fall below specified strength (f_c').
B. Specified Strength (f_c'): The strength of concrete to be supplied and installed.

1.4 **SUBMITTALS**

A. Mix design: Submit
1. Date of mix design. If mix design is older than 290 days on day of submittal, the mix design must be recertified. Submit the mix design 10 days prior to use.
2. Source and type of cement and its percentage of expansion (refer to Article 2.1).
3. Physical properties of coarse, fine and combined aggregate (refer to Article 2.3).
4. Average concrete strength (f_c') per quality control chart. (refer to Article 2.7).
5. Size of coarse aggregate.
6. Allowable range of slump and air content.
7. Water/cement ratio.
8. Proportions of materials in the mix.
9. Unit weight.
10. Analysis of water to be used unless potable.
11. Technical data sheets for additives to be used at the plant and at the job site (refer to Article 2.4). Certify additives are compatible with each other.
B. Pre-approved mix design, submit name and address of supplier
C. Before changing mix design submit a new mix design and give ENGINEER 10 days to evaluate the changes.
D. Quality Control Report: Upon ENGINEER's request, submit a written quality

control inspections and testing report describing source quality control activities performed by CONTRACTOR and CONTRACTOR's suppliers (refer to Article 2.7).

1.5 **QUALITY ASSURANCE**

A. Reject concrete that does not meet requirements of this section.
B. Do not change material sources, type of cement, air-entraining agent, water reducing agent, other admixtures except as allowed by mix design.
C. Store bagged and bulk cement in weatherproof enclosures. Exclude moisture and contaminants.
D. Prevent segregation and contamination of stockpiled aggregate.
E. Avoid contamination, evaporation, or damage to admixtures. Protect liquid admixtures from freezing.
F. Use of admixtures will not relax hot or cold weather placement requirements.

PART 2 PRODUCTS

2.1 **CEMENT**

A. General:
   1. Do not use air-entraining cement except for hand mixed applications.
   2. Do not use cement that contains lumps or is partially set.
   3. Do not mix cement originating from different sources.
   4. Cement must meet the following mortar bar expansion requirements per option R in table-1 of ASTM C 1157 if aggregate is alkali-reactive (see Article 2.3).
      a. Expansion at 14 days = <0.020-percent.
      b . Expansion at 56 days = <0.060-percent.
B. Portland Cement. ASTM C 150.
   1. Type II for placements on or below ground. Type V when necessary.
   2. Low-alkali cement per ASTM C 150 table 2
C. Rapid Set Portland Cement: As above and the following.
   1. Initial set time: 15 minutes minimum.
   2. Color: Acceptable to the ENGINEER.
D. Blended Hydraulic Cement: ASTM C 595 and ASTM C 1157.
   1. Type IP if substituted for Type I cement.
   2. Type IP(MS) if substituted for Type II cement.
   3. Type HS if substituted for Type V cement.
   4. When blended cement is used with reactive aggregate, use Option R specified in ASTM C 1157. Conform to requirements of ASTM C 595.
   5. Do not use fly ash as a replacement for any blended cement.

2.2 **WATER**

A. Clean, non-staining and non-detrimental complying with AASHTO T 26. Do not use alkali soil water.

2.3 **AGGREGATES**

A. Material: Gravel, crushed slag, crushed stone, or other inert materials, composed of

hard, strong, durable particles.

B. Reactivity: Meet both of the following. If aggregate does not comply, follow design requirements for reactive aggregate. See Article 2.5.
   1. Mean mortar bar expansion at 16 days is less than 0.10-percent per ASTM C 1260 (with no modifications).
   2. Petrography examination per ASTM C 295 reveals.
      a. Optically strained, microfractured, or microcrystalline quartz: 5.0% maximum.
      b. Chert or chalcedony: 3.0% maximum.
      c. Tridymite or cristobalite: 1.0% maximum.
      d. Opal: 0.5% maximum.
      e. Natural volcanic glass in volcanic rocks: 3.0% maximum.

C. Soundness: ASTM C 88.
   1. Coarse Aggregate: 12-percent or less weight loss when subjected to 5 cycles of sodium sulfate; or 18-percent or less weight loss when subjected to 5 cycles of magnesium sulfate.
   2. Fine Aggregate: 10-percent or less weight los when subjected to 5 cycles of sodium sulfate; or 15-percent or less weight loss when subjected to 5 cycles of magnesium sulfate.

D. Percentages of Wear: ASTM C 131.
   1. 15-percent maximum at 100 revolutions.
   2. 52-percent maximum at 500 revolutions.

E. Deleterious Substances: ASTM C 33 Table 3 class designation 4S.

2.4 **ADMIXTURES**

A. Calcium Chloride: Not allowed.

B. Air Entrainment: Per ASTM C 260. For extrusion enhancement use non-vinsal resin.

C. Set Enhancement and Water Reducing Agents: Per ASTM C 494.
   1. Type A: Water reducing.
   2. Type B: Set retarding.
   3. Type C: Set accelerating.
   4. Type D: Water reducing and set retarding.
   5. Type E: Water reducing and set accelerating.
   6. Type F: High range water reducing (super plasticizer).
   7. Type G: High range water reducing and set retarding. *

      * Keep the relative durability factor of water reducing admixtures not less than 90 and the chlorides content (as Cl-) not exceeding 1-percent by weight of the admixtures.

D. Pozzolan:
   1. Natural or fly ash per ASTM C 618.
   2. Silica fume per ASTM C 1240.

E. Lithium nitrate based solution for control of reactive aggregates.

F. Calcium nitrite based solution for corrosion protection of reinforced structures subject to chloride induced corrosion.

G. Shrinkage Reducing Admixtures: For controlling drying shrinkage in concrete.

2.5 MIX DESIGN

A. Selection of Aggregates.

1. Gradation: Per ASTM C 33.

ASTM Size No.	Maximum Particle Size.
357	2"
467	1-1/2"
57	1"
67	3/4"

The amount of material smaller than the No. 200 sieve in any combined gradation sample is limited to 1.75% maximum by weight of the combined sample.

2. Maximum Particle Size:
   a. 1/5 of narrowest dimension between forms.
   b. 1/3 of depth of slab.
   c. 3/4 of minimum clear spacing between reinforcing bars.
3. Reactivity:
   a. Mean mortar bar expansion at 365 days is less than 0.04 percent per ASTM C 1293, or
   b. Historical data acceptable to ENGINEER.

B. Selection of Pozzolan:

1. General: If an aggregate passes an unmodified ASTM C 1293 test, the use of a pozzolan is the CONTRACTOR's option. For aggregates failing an unmodified ASTM C 1293 test, select a pozzolan (or blended cement, or both) and determine the minimum effective dosage that passes one of the following criteria.
   a. ASTM C 1260. The expansion of a cement-pozzolan aggregate job-mix mortar bar is less than or equal to 0.10 percent in 16 days. Do not use this criterion if a lithium admixture is used in the job-mix.
   b. ASTM C 441. The expansion of the test mixture in 56 days is less than or equal to a control mixture prepared with cement with equivalent alkalis between 0.5 and 0.6-percent.
2. Fly Ash (Class F): Allowed as a cement replacement under the following conditions.
   a. Replace up to 20-percent of the cement by weight on a basis of 1.25 parts fly ash to 1 part cement.
   b. Use the minimum cement content in the design formulas before replacement is made.
   c. Establish the water/cement ratio before cement is replaced with pozzolan.
   d. Submit to the ENGINEER a quality history of the fly ash identifying a minimum of 20 of the most current ASTM C 618 analyses.
3. Natural Pozzolan (Class N): The 14 day expansion test (ASTM C 1260) with job aggregates, job cement and natural pozzolan does not exceed the 14 day expansion test of job aggregates, job cement and Class F fly ash.
4. Silica Fume: Maximum of 10% by mass replacement of hydraulic cement on a basis of 1 part silica fume to 1 part cement.

C. Selection of Fiber Reinforcement: The basis for determining material proportions of fiber-reinforced concrete is the supplier's responsibility per ASTM C 1116 subject to requirements of this section. Unless specified otherwise provide synthetic fibers.

D. Physical Properties of Mix: Select and proportion concrete mix materials using ACI 211.1, 211.2 or 211.3 procedures.
   1. Unless allowed otherwise by ENGINEER, increase the amount of cement in the mix design by 1 sack between October 1 and March 1, i.e. 5.5 becomes 6.5 or 6.5 becomes 7.5.
   2. If air temperature is greater than 75 deg. F. reduce temperature of mix ingredients or use an admixture appropriate to job conditions.
   3. Maximum slump is 8-inches after the addition of a high range water reducer (super-plasticizer) at site.
   4. When concrete is deposited under water, use one more sack of cement per cubic yard than the design requires for concrete placed above water.

Table 3 – Mix Properties and Limitations

		Limitations per Concrete Class					
Properties	**Test Method**	**Class 2000**	**Class 3000**	**Class 4000**	**Class 5000**	**Class 6000**	**Class 7000**
Compressive Strength *(f_c')* at 28 days, psi, min.	ASTM C 39	2000	3000	4000	5000	6000	7000
Compressive Strength at 7 days, psi, min.	ASTM C 39	1340	2010	2680	3350	4020	4690
Flexural Strength (R) at 28 days, psi, min.	ASTM C 78	450	550	650	725	775	850
Average Strength *(f_{cr})*	ACI 214	(b)	(b)	(b)	(b)	(b)	(b)
Cement content, sacks, min. (a)	–	4,5	5.5	6.5	(c)	(c)	(c)
Water-cement ratio (by weight), max.(a)	ACI 318	--	--	. 44	--	--	--
Entrained air content (% by pressure)(d)	ASTM C 231	3 to 5.5	5 to 7	5 to 7	--	--	--

NOTES

(a) Before pozzolan substitution. (94 lb. sacks of cement per cubic yard of concrete).
(b) The amount by which the average strength *(for)* exceeds the compressive strength (fo') is based upon no more than 1 in 100 average strength tests falling more than 500 psi below the specified strength.
(c) Cement content shall be appropriate to produce a mixture having strength, durability and workability as specified or required for job conditions.
(d) The air content shall be appropriate to the aggregate size and "exposure" conditions. When selecting or changing air content comply with ACI 211.1

2.6 SOURCE QUALITY CONTROL

A. Once selected, do not change source quality control sampling point.
B. Aggregate:
   1. Soundness: Evaluate aggregate per ASTM C 88.
   2. Alkali-silica Reactivity: Evaluate aggregate per ASTM C 289, C 1260, C 227 and C 1293. Petrographically examine fine and coarse aggregate sources once every 3 years per ASTM C 295.
C. Portland Cement Concrete Mix: Obtain number of samples recommended by ACI 301 and test each for the following.
   1. Compressive strength per ASTM C 39.
   2. Slump, air, and temperature per ASTM C 231.
D. Concrete Quality Charts: Comply with ACI 214 and ACI 301. Plot new results and identify trends on quality control charts that comply in form to ASTM STP 15-C. Show the specified strength (f0), the required average strength (fi), and the compressive strength versus date of sample.
E. Equipment: Certify through the services of a irofessiona1 engineer that trucks and plant equipment comply with the requirements of the National Ready Mixed Concrete Association. Do so at least every 2 years.
   1. Transit Trucks: Equip transit trucks with plates indicating total volume, agitating volume and mix volume.
   2. Weights and Measures: Comply with regulatory requirements of State of Utah.

PART 3 EXECUTION

3.1 CONSTRUCTION EQUIPMENT

A. Trucks: ASTM C 94.
   1. Truck Mixer: Fill drum no more than 63-percent of the gross drum volume. Use drum manufacturer's recommended mixing speed (between 12 - 18 rpm).
   2. Truck Agitator: Do not fill drum greater than 80-percent of the gross drum volume. Use drum manufacturer's recommended agitating speed (between 2 - 6 rpm).
B. Mixing Plant: ASTM C 94.
   1. Use option C and requirements in this section for preparing ready-mixed concrete.
   2. Use scales certified by the State of Utah. Do not use volume measurement

except for water and liquid admixtures.

3. Mixing time must exceed 80 seconds after adding air entrainment admixture.

C. Hand Mixing:

1. Do not hand mix batches larger than 0.5 cubic yards.
2. Hand mix only on a watertight platform.
3. Ensure all stones are thoroughly covered with mortar and mixture is of uniform color and consistency prior to adding water.

3.2 INSTALLATION

A. Placement; Section 03310.

B. Restoration of roadway cuts; Section 02985.

END OF SECTION

SECTION 03305

SAMPLING AND TESTING

This specification is from the APWA Manual of Standard Specifications, 2002 Edition. All other provisions remain in full force and effect.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete sampling and testing requirements.

1.2 REFERENCES

A. ACI 318: Building Code Requirements of Reinforced Concrete.
B. ASTM C 31: Standard Practice for Making and Curing Concrete Test Specimens in the Field.
C. ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
D. ASTM C 42: Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams fo Concrete.
E. ASTM C 78: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
G. ASTM C 138: Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
H. ASTM C 143: Standard Test Method for Slump of Portland Cement Concrete.
I. ASTM C 172: Standard Method of Sampling Freshly Mixed Concrete.
J. ASTM C 173: Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
K. ASTM C 231: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
L. ASTM C 567: Standard test Method for Unit weight of Structural Lightweight Concrete.
M. ASTM D 1077: Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

1.3 SUBMITTALS

A. Concrete Supplier: If requested, submit reports and material certificates verifying concrete quality control.
B. Laboratory: Promptly submit test data results for 7 and 28 day breaks to ENGINEER, CONTRACTOR, and Supplier.

1.4 QUALITY ASSURANCE

A. Provide an ASTM D 1077 compliant and ACI certified laboratory.
B. Provide level I ACI certified field sampling technicians.

1.5 SITE CONDITIONS

A. Assist ENGINEER: Furnish labor to assist ENGINEER in obtaining and handling acceptance samples at site or sources.
B. Store and Cure Tests Specimens: Safely store and cure concrete test specimens and acceptance test specimens for first 24 hours.
   1. Maintain cylinders or beams within a temperature range of 60° to 80° F. per ASTM C 31 for the initial 16 hour curing period. Do not move the cylinders or beams during this period.
   2. Equip the storage device with an automatic 24 hour temperature recorder with an accuracy of ±2° F.
   3. Use water containing hydrated lime if water is to be in contact with cylinders or beams.
   4. Ensure the device(s) can accommodate the required number of test cylinders or beams. Lack of capacity will cause the placement of concrete to cease.
   5. Have the storage devices available at the point of placement at least 24 hours before placement.
   6. A 24 hour test run may be required.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION

3.1 **PRECAST PRODUCTS**
A. Obtain composite samples from different portions of the batch.
B. Make and cure concrete test specimens for acceptance per ASTM C 31.
C. Cure all precast products with water vapor or water.
D. So not damage precast products by stripping forms or handling before the concrete reaches its specified strength.

3.2 **CAST-IN-PLACE PRODUCTS**
A. Obtaining Samples: Obtain composite samples from different portions of the batch per ASTM C 172. Obtain core samples per ASTM C 42.
B. Identify location of test on test reports.
C. Compressive Strength:
   1. Mold 4 test specimens per ASTM C 31.
   2. For each strength test perform slump, air, and temperature test.
   3. Determine strength per ASTM C 39. Test 1 cylinder at 7 days and 3 cylinders at 28 days.
   4. If any one cylinder in a 28 day test shows definite evidence of improper sampling, molding, handling, curing, or testing, discard the cylinder. The average strength of the remaining cylinders shall be considered the test result.
D. Tensile (Flexural) Strength:
   1. Mold 4 test specimens per ASTM C 31.
   2. For strength test perform slump, air, and temperature test.
   3. Determine strength per ASTM C 78. Test 1 beam at 7 days and 3 beams at 28 days.
   4. If any one beam in a 28 day test shows definite evidence of improper sampling, molding, handling, curing, or testing, discard the beam. The average strength of

the remaining beams shall be considered the test result.

E. Aggregate: ASTM C 136 for fine and coarse aggregate.
F. Slump Test: ASTM C 143.
G. Air Test:
   1. Normal weight concrete: ASTM C 231.
   2. Light weight concrete: ASTM C 173.
H. Unit Weight:
   1. Normal weight concrete: ASTM C 138.
   2. Light weight concrete: ASTM C 567.
I. When requested, test in-place concrete by impact hammer, sonoscope, or other non-destructive device:
   1. To determine relative strengths in various locations in Work.
   2. To aid in evaluating concrete strength.
   3. To select areas to be cored.
   4. To verify quality control in the absence of control testing.

3.3 RETESTING DEFECTIVE CONCRETE

A. If CONTRACTOR desires to do a retest, a request to ENGINEER for retesting must be made within 35 days from time of concrete placement. No coring or retesting shall be done after 40 days have elapsed from the time of placement.
B. CONTRACTOR must follow procedures outlined for retesting in Section 01460 and the following:
   1. Obtain and test cores per ASTM C 42 requirements. Secure a minimum of 3 randomly selected core samples from each sublot considered defective. Randomly select and coordinate test locations with ENGINEER.
   2. If concrete placed in the Work will be dry under service conditions, air dry cores for 7 days before tests. Unless otherwise specified, use air temperature 60° to 90° F. and relative humidity less than 60 percent.
   3. If concrete placed in the Work will be more than superficially wet under service conditions, test cores after moisture conditioning (liquid or vapor water cure).
   4. If more than 1 core shows evidence of having been damaged before testing, provide replacement cores, otherwise evaluation will be done on 2 or more core samples.
   5. Evaluate cores in accordance with ACI 318 requirements.
   6. If core test are inconclusive, or impractical to obtain, or if structural analysis does not confirm the safety of the Work, load test may be used and evaluated in accordance with ACI 318 requirements.
C. Coat sides of core hole with concrete epoxy resin adhesive. Fill core holes with non-shrink low slump concrete mortar. Match color and texture of surrounding concrete.

END OF SECTION

SECTION 03310

CONCRETE WORK

This specification is from the APWA Manual of Standard Specifications, 2002 Edition. All other provisions remain in full force and effect.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete placement operations for cast-in-place slabs on grade, slabs on fill, structural building frame, and other concrete.

1.2 REFERENCES

A. ACI 301: Specifications for Structural Concrete for Buildings.
B. ACI 305: Hot Weather Concreting.
C. ACI 306.1: Cold Weather Concreting.
D. ACI 309: Standard Practice for Consolidation of Concrete.
E. ASTM C 881: Standard Specification of Epoxy-Resin-Base Bonding Systems for Concrete.
F. ASTM C 1059: Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

1.3 SUBMITTALS

A. Batch Delivery Ticket: For each batch delivered to site, submit:
   1. Date.
   2. Producer and plant.
   3. Job.
   4. Name of contractor.
   5. Serial number of ticket.
   6. Truck number and time dispatched.
   7. Volume of concrete.
   8. Type of cement.
   9. Amount of cement.
   10. Total water content (W/C ratio).
   11. Water added for receiver of concrete and receiver's initials.
   12. Admixture types and amounts.
   13. Separate weights of fine and coarse aggregate.
   14. Statement of whether batch is pre-mixed at plant or mixed in transit.
B. Record of Placed Concrete: Submit record date, location of pour, quantity, air temperature, and CONTRACTOR's quality control test samples taken.
C. Bonding Compound: Submit product name, type, and chemical analysis.

1.4 QUALITY ASSURANCE

A. Provide ACI certified finishers.
B. Remove and replace any placed concrete suffering hot or cold weather damage.
C. For control testing follow Section 03305 requirements.

1.5 **ACCEPTANCE**

A. Concrete work that fails to meet any of the following requirements will be considered defective. Replace any defective work at no additional cost to the OWNER.
   1. Placement:
      a. Reinforcing steel size, quantity, strength, position, damage, or arrangement is not as specified or does not comply with code.
      b. Formwork differs from required dimensions or location in such a manner as to reduce concrete's strength or load carrying capacity or physical esthetics.
      c. Workmanship likely to result in deficient strength.
   2. Finishing:
      a. Concrete exposed to view has defects that adversely affect appearance.
      b. Slab tolerances of Section 03350 are not met.
   3. Protection:
      a. Method of curing is not as specified.
      b. Inadequate protection of concrete from temperature extremes during early stages of hardening and strength development.
      c. Mechanical injury, construction fires, accidents, or premature removal of formwork likely to result in deficient strength development.

B. CONTRACTOR may request ENGINEER determine appropriate modifications or payment adjustments to correct defective work.

PART 2 PRODUCTS

2.1 **MATERIALS**

A. Concrete: Class as indicated, material per Section 03304.
   1. For roadway cuts, refer to Section 02985.

B. Bonding Compound: Type II (Non-redispersible) polyvinyl acetate base or acrylic base latex per ASTM C 1059.

C. Vapor Retarder: 10 mil thick clear polyethylene sheet. Type recommended for below grade application.

D. Forms: Refer to Section 03100.

E. Reinforcement: Refer to Section 03200.

F. Coverings and Curing Compound: Refer to Section 03390.

G. Shrinkage Compensating Grout: Refer to Section 03600.

H. Epoxy Adhesive: Refer to Section 03600.

PART 3 EXECUTION

3.1 **PREPARATION**

A. Notify ENGINEER minimum 24 hours prior to commencement of concrete placement operations.

B. Do not allow construction loads to exceed member capacity.

C. Clean previously placed concrete. Apply bonding compound per manufacturer's instructions.

D. At locations where new concrete is dowelled to existing work, drill, insert and pack steel dowels with shrink compensating grout.

3.2 **EXAMINATION**

A. Verify items to be cast into concrete are accurately placed and held securely.
B. Verify slump range on delivery ticket matches mix design.
C. Verify slab steel mats are supported by steel chairs, precast concrete blocks, or other slab bolsters. Do not pour if absent.

3.3 **DELIVERY**

A. Slump: Keep slump within the allowable range.
B. Placement Time:

Air Temperature	**Time After Initial Batching**
Less than 90° F.	1 ½ hours
Greater than 90° F.	1 hour (without retarder)
Greater than 90° F.	1 ½ hours (with retarder)

C. Tempering:
   1. When concrete arrives at site with slump below specified, water may be added if the maximum approved water/cement ratio and the maximum slump is not exceeded provided that:
      a. The approved mix design has allowed for addition of water.
      b. The amount of water added is accurately measured to ±1 gallon of the desired added amount.
      c. That water addition is followed by 3 minutes of mixing at mixing speed prior to discharge.
      d. That the person authorized to add water is mutually approved of in writing by ENGINEER, CONTRACTOR and ready-mix Supplier.
   2. **Do not add water after concrete discharge from the delivery vehicle.**
D. Super-plasticizer: Comply with manufacturer's requirements. If none, then as follows:
   1. If added at site, add agent using injection equipment capable of rapidly and uniformly distributing the admixture to the concrete. Prior to discharge, mix for a minimum of 5 minutes at a drum rate not less than 12 rpm or more than 15 rpm.
   2. If added at plant, do not deliver to site unless batch delivery ticket displays water/cement ratio prior to super-plasticizer addition.
   3. Tempering with super-plasticizer after expiration of allowable delivery times is prohibited.

3.4 **CONCRETE PLACEMENT**

A. Place concrete per ACI 301.
   1. Hot Weather Placement: Place per ACI 305. If the rate of evaporation approaches 0.2 lb./ft^2/hr. precautions against plastic shrinkage cracking are necessary (i.e. dampening subgrade and forms; placing concrete at the lowest possible temperature; erecting windbreaks and sunshades; fog sprays; use of evaporation retardants; or rescheduling time of placement).
   2. Cold Weather Placement: Place per ACI 306. Non-chloride accelerating admixture may be used in concrete work placed at ambient temperatures below

50° F. Use of admixtures will not relax cold weather placement requirements.

B. Concrete Temperature: Keep mixed concrete temperature at time of placement between 60° and 90° F.
C. Do not disturb reinforcement, inserts, embedded parts, and formed joints.
D. Do not break or interrupt successive pours such that cold joints occur.
E. Honeycomb or embedded debris in concrete is not acceptable.

3.5 JOINTS AND JOINT SEALING

A. Section 03060.

3.6 CONSOLIDATION

A. ACI 309.
B. Keep spare vibrator available during concrete placement operations.

3.7 FINISHING

A. Section 3350.
B. Unless specified otherwise, finish as follows:
   1. Sidewalks, garage floors, and ramps: Broom or belt finish.
   2. Exterior concrete pavement: Broom or belt finish.
   3. Exterior platforms, steps, and landings, exterior and interior pedestrian ramps, not covered by other finish materials: Non-slip finish.
   4. Surfaces intended to receive bonded applied cementitious applications: Scratched finish.
   5. Surfaces intended to receive roofing, except future floors, waterproofing membranes, and roof surfaces that are future floors or sand bed terrazzo: Floated finish.
   6. Floors and roof surfaces that are floors intended as walking surfaces or to receive floor coverings: Troweled finish.
   7. Unpainted concrete surfaces not exposed to public view: Rough as-cast form finish.
   8. Unpainted concrete surfaces exposed to public view: Smooth as-cast form finish.
   9. Concrete surfaces to receive paint of plaster: Grout cleaned finish.

3.8 CURING

A. Section 03390.
B. Use a membrane forming compound unless specified otherwise.

3.9 DEFECTIVE CONCRETE

A. Modify or replace concrete not conforming to required levels, lines, details, and elevations.
B. Structural analysis and additional testing may be required at no additional cost to OWNER when the strength of a structure is considered potentially deficient.
C. Patch imperfection. Refer to Section 03350 requirements.

3.10 PROTECTION AND REPAIRS

A. Follow Section 01660 requirements.

B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

END OF SECTION

SECTION 03350

FINISHING

This specification is from the APWA Manual of Standard Specifications, 2002 Edition. All other provisions remain in full force and effect.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Finishing interior and exterior concrete surfaces.

1.2 REFERENCES

A. ACI 303: Guide to Cast-in-Place Architectural Concrete Practice.

1.3 SUBMITTALS

A. Name, date, chemical analysis and manufacturer's recommended rate of application for liquid chemical hardener.

1.4 PROJECT CONDITIONS

A. Protect adjacent materials and finishes from dust, dirt and other surface or physical damage during finishing operations. Provide protection as required and remove from site at completion of Work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Mortar and Grout: Refer to Section 03600.
B. Dry Shake: Blend of metallic or mineral aggregate with Portland cement concrete in proportions recommended by manufacturer.
C. Proprietary Materials: If permitted or required, proprietary compounds may be use in lieu of or in addition to foregoing materials. Use such compounds per manufacturer's recommendations.
D. Liquid-Chemical Hardener: Colorless, aqueous solution containing a blend of magnesium fluosilicate, zinc fluosilicate and a wetting agent. Mixture contains not less than 2 pounds fluosilicate per gallon and does not interfere with adhesives and bonding.

PART 3 EXECUTION

3.1 PREPARATION

A. Examine the areas and conditions under which work of this section will be performed.
B. Correct conditions detrimental to timely and proper finishing.
C. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISHING HORIZONTAL SLABS

A. **Do not apply water (i.e. sprinkle) to any surface of concrete when finishing slabs.**

B. Slab finishing tolerances:
   1. Class A finish: 1 in 1000.
   2. Class B finish: 1 in 500.
   3. Class C finish: 1 in 250.

C. Float Finish: After concrete has been placed, consolidated, struck-off, and leveled, do not work further until ready for floating.
   1. Begin floating when water sheen has disappeared and surface has stiffness sufficient to permit operation.
   2. During or after first floating, check planeness of entire surface with a 10 foot long straightedge applied at 2 or more different angles.
   3. Cut down high spots and fill low spots to the required tolerance.
   4. Refloat slab immediately to a uniform sandy texture.

D. Trowel Finish:
   1. Float finish surface.
   2. Power trowel.
   3. Hand trowel as required to provide surface.
   4. First troweling after power floating shall produce smooth surface relatively free of defects but which may still show some trowel marks.
   5. Second trowel by hand after surface has hardened.
   6. Leave finished surface essentially free of trowel marks, uniform in texture and appearance.
   7. On surfaces intended to support floor coverings, grind off defects that would show through floor covering.

E. Broom or Belt Finish: Sweep surface with brushes, rakes, tines or burlap belt before final set.

F. "Dry Shake" Finish: Give the surface a floated finish. Evenly apply approximately 2/3 of a blended unsegregated material.
   1. Begin floating immediately after application of first "dry shake".
   2. After material has been embedded by floating, apply remainder of blended material to surface at right angles to previous application.
   3. Make second application heavier in any areas not sufficiently covered by first application.
   4. Immediately follow with second floating.
   5. After selected material has been embedded by second floating, complete operation with a broomed, floated, or troweled finish, as indicated.

G. Non-slip Finish: Give surface a "dry shake" application, using crushed ceramically bonded aluminum oxide particles. Apply at 25 pounds per 100 square feet.

H. Exposed Aggregate Finish: Immediately after surface of concrete has been leveled to tolerance and surface water has dissipated, spread aggregate uniformly over surface to provide complete coverage to the depth of a single stone.
   1. Embed aggregate into surface by light tamping.
   2. Float surface until embedded aggregate is fully coated with mortar and surface has been brought to tolerance.
   3. Start exposure of aggregate after matrix has hardened sufficiently to prevent dislodgment.

4. Flow ample quantities of water, without force, over surface of concrete while matrix encasing aggregate is removed by brushing with a fine bristle brush.
5. Continue until aggregate is uniformly exposed.
6. An approved chemical retarder sprayed onto freshly floated surface may be used to extend working time.

I. Chemical-Hardener Finish: Apply liquid chemical-hardener finish to interior concrete floors where indicated. Do not apply liquid chemical hardener on floor areas scheduled to receive synthetic matrices terrazzo, setting beds for tile, terrazzo, vinyl flooring, or like items. Apply hardener after complete curing and drying of concrete surface per manufacturer's recommendations. Evenly apply each coat, and allow 24 hours for drying between coats. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

3.3 FINISHING FORMED SURFACES

A. General:
   1. Allow concrete to cure not more than 72 hours before commencing surface finish operations, unless approved otherwise.
   2. Revise the finishes as needed to secure approval.

B. As-Cast Form Finish:
   1. Rough: Patch defects, chip or rub off fins exceeding 1/4 inch height.
   2. Smooth: Patch tie holes and defects and remove fins completely.
      a. When surface texture is impaired and form joints misaligned, grind, bush-hammer, or correct affected concrete.
      b. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete.
      c. Repair major mortar leakage as a defective area.
      d. When workmanship is less than acceptable standard, provide one of rubbed finishes at no additional cost to OWNER.

C. Rubbed Finish:
   1. Smooth Rubbed: Remove forms and perform necessary patching as soon after placement as possible.
      a. Finish newly hardened concrete no later than 24 hours following form removal.
      b. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.
   2. Grout Cleaned: Undertake no cleaning operations until all contiguous surfaces are completed and accessible.
      a. Wet surfaces of concrete sufficiently to prevent absorption of water from grout.
      b. Apply grout uniformly.
      c. Immediately after grouting, scrub surface with cork float or stone to coat surface and fill voids.
      d. While grout is still plastic, remove excess grout by working surface with rubber float or sack.
      e. After surface whitens from drying, rub vigorously with clean burlap.
      f. Keep damp for at least 36 hours after final rubbing.

3. Cork Floated: Remove forms within 2 to 3 days of placement where possible.
    a. Remove ties.
    b. Remove all burrs and fins.
    c. Dampen wall surface.
    d. Apply mortar with firm rubber float or with trowel, filling all surface voids.
    e. Compress mortar into voids.
    f. If mortar surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with fog sprayer.
    g. Produce final texture with cork float using a swirling motion.

D. Unformed Finish:
1. After concrete is placed, strike smooth, tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces.
2. Float to texture that is reasonably consistent with formed surfaces.
3. Continue final treatment on formed surfaces uniformly across unformed surfaces.

E. Blasted Finish:
1. Perform abrasive blasting within 24 to 72 hours after casting.
2. Coordinate with form work construction, concrete placement schedule, and formwork removal to ensure that surfaces are blasted at the same age for uniform results.
3. Reapply curing protection after blast finishing.

F. Architectural Finish: Refer to ACI 303.
1. Tooled Finish:
    a. Dress thoroughly cured concrete surface with electric, air, or hand tools to uniform texture, and give a bush hammered surface texture.
    b. Remove sufficient mortar to exposed coarse aggregate in relief and to fracture coarse aggregate for tooled finish.

G. Patched Finish:
1. Repair defective areas.
    a. Remove honeycomb and defective concrete to sound concrete.
    b. Make edges perpendicular to surface or slightly undercut.
    c. Featheredged are not permitted.
    d. Dampen area to be patched and at least 6 inches surrounding it to prevent absorption of patching mortar water.
    e. Prepare bonding grout.
    f. Mix to consistency of thick cream.
    g. Brush into surface.
2. Tie Holes: Unless indicated otherwise, after being cleaned and thoroughly dampened, fill tie hole solid with patching mortar.
3. Make any patches in concrete to closely match color and texture of surrounding surfaces. Determine mix formula for patching mortar by trial and obtain a good color match with concrete when both patch and concrete are cured and dry.
    a. Mix a white and gray Portland cement as required to match surrounding concrete to produce grout having consistency of thick paint.
    b. Use a minimum amount of mixing water.
    c. Mix patching mortar in advance and allow to stand without frequent

manipulation, without addition of water, until it has reached stiffest placeable consistency.

d. After initial set, dress surfaces of patches manually to obtain some texture as surrounding surfaces.

4. After surface water has evaporated from patch area, brush bond coat into surface.
   a. When bond coat begins to lose water sheen, apply patching mortar.
   b. Thoroughly consolidate mortar into place and strike-off to leave patch slightly higher than surrounding surface.
   c. Leave undisturbed for at least 1 hour before final finish.
   d. Keep patched area damp for 72 hours or apply curing compound.
   e. Do not use metal tools in finishing an exposed patch.
5. Where as-cast finishes are indicated, total patched area may not exceed 1 in 500 of as-cast surface. This is in addition to form tie patches, if ties are permitted to fall within as-cast areas.
6. In any finishing process which is intended to expose aggregate on surface, patched areas must show aggregate.
   a. Outer 1 inch of patch shall contain same aggregates as surrounding concrete.
   b. For aggregate transfer finish, patching mixture shall contain same selected colored aggregates.
   c. After curing, expose aggregates together with aggregates of adjoining surfaces by same process.

END OF SECTION

SECTION 03390

CURING

This specification is from the APWA Manual of Standard Specifications, 2002 Edition. All other provisions remain in full force and effect.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete curing requirements.

1.2 REFERENCES

A. ACI 301: Specifications for Structural Concrete for Buildings
B. ACI 305: Hot Weather Concreting.
C. ACI 306.1: Cold Weather Concreting
D. ASTM C 171: Standard Specification for Sheet Materials for Curing Concrete.
E. ASTM C 1315: Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

1.3 SUBMITTALS

A. Submit manufacturer certificates per Section 01430 that shows product meets performance criteria.
B. Submit manufacturer's recommended installation procedures which, when accepted by ENGINEER, will become the basis for accepting or rejecting installed product.

1.4 QUALITY ASSURANCE

A. Use workers knowledgeable of ACI 301, 305, 306.1.

1.4 PRODUCT HANDLING

A. Protect materials of this section before, during, and after installation.
B. Protect the work and materials of other trades.
C. In the event of damage, immediately make replacements and repair at no additional cost to OWNER.

1.5 WEATHER LIMITATIONS

A. Above 75 deg. F.; ACI 305
B. Below 55 deg. F.; ACI 306.1.

PART 2 PRODUCTS

2.1 COVERS

A. Water or Fog-spay: Clean, non-staining and non-detrimental to concrete.
B. Sheet Coverings: White waterproof paper, polyethylene film, or polyethylene coated burlap sheet complying with ASTM C 171.
C. Mat Coverings: Clean roll goods of cotton or burlap fabric.

D. Insulating Coverings: Non-staining curing blankets.

2.2 **MEMBRANE FORMING COMPOUND**

A. Material.
   1. Styrene-acrylic
   2. Styrene-butadiene
   3. Alpha-methylstyrene
   4. Chlorinated rubber

B. Performance Criteria: ASTM C 1315 compound.
   1. Type ID Class A (clear with fugitive dye), or
   2. Type II Class A or B (white pigmented).

C. Volatile Organic Compounds (VOC): Comply with local, state and federal requirements.

2.3 **PENETRATING/CURING COMPOUND**

A. Styrene acrylic silane co-polymer with performance criteria as specified in Section 07190.

PART 3 EXECUTION

3.1 **PREPARATION**

A. Make surfaces dry and free of laitance, dirt, dust, paint, grease, oil, rust, and oilier contaminants.

B. Do not use membrane forming curing compound on surfaces that are to receive hardeners.

3.2 **APPLICATION - COVERS**

A. Water: Apply water-fog spray or ponding.

B. Absorptive Mat: Place absorptive mat to provide coverage of concrete surfaces and edges. Lap over adjacent absorptive covers. Thoroughly saturate with water and keep continuously wet.

C. Moisture-Retaining Sheet: Place cover in widest practicable width with sides and ends lapped and sealed to prevent moisture loss. Repair any holes or tears during curing period.

D. Formed Surface Curing: Cure formed concrete surfaces, including underside of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period. If forms are removed prior to curing completion, applying cure film or penetrant or use methods indicated above, as applicable.

3.3 **APPLICATION – MEMBRANE FORMING COMPOUND**

A. Apply coating continuously and uniformly. Follow manufacturer's recommendations

B. Protect continuity of film coatings and repair damage during cure period.

C. If forms are removed before expiration of cure period, apply coating to unprotected areas.

3.4 **SCHEDULE**

A. Concrete Exposed to Potable Water (as in Water Storage Reservoirs):
   1. Moisture cover curing.
   2. Acrylic cure.
   3. Styrene acrylic silane co-polymer cure.

END OF SECTION

SECTION 03400

PRECAST CONCRETE

This specification is from the APWA Manual of Standard Specifications, 2002 Edition. All other provisions remain in full force and effect.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pre-cast concrete, complete with required connecting and supporting devices.

1.2 REFERENCES

a. ACI 318: Building Code Requirements for Reinforced Concrete. This reference standard includes other ASTM material standards.
B. ASTM A 36: Standard Specification for Structural Steel.
C. ASTM C 478: Standard Specification for Precast Reinforced Concrete Manhole Sections.
D. ASTM C 858: Standard Specification for Underground Precast Concrete Utility Structures.
E. AWS D1.1: Structural Welding Code Steel.
F. AWS D1.4: Structural Welding Code Reinforcing Steel.
G. PCI: Design Handbook.
H. PCI MNL-116: Quality Control and Assurance for Plant Production of Prestressed Concrete.
I. PCI MNL-117: Quality Control and Assurance for Plant Production of Architectural Precast Concrete.

1.3 MANUFACTURER AND ERECTOR QUALIFICATIONS

A. Manufacture and transportation only by company experienced in providing precast products and services normally associated with precast and prestressed concrete construction.
B. Welders: Certified per AWS D1.1 and AWS D1.4.

1.4 DESIGN CRITERIA

A. Design precast concrete units per ACI 318 and PCI design handbook.
B. Under direct supervision of Professional Engineer who is fully experienced in design of units.
C. Design units to support required stripping and handling loads, live, dead and construction loads.
D. Design component connections to provide adjustment to accommodate misalignment of structure during installation.

1.5 SHOP DRAWINGS

A. Prepare shop drawings under seal of licensed professional.
B. Submit shop drawings per Section 01330.

C. Indicate unit locations, unit identification marks, fabrication details, reinforcement, connection details, pertinent dimensions, and erection support points. Unit identification marks to appear on all manufactured units.
D. Do not proceed with fabrication until shop drawings have been accepted.

1.6 **DELIVERY, STORAGE AND HANDLING**

A. Handle precast units in positions consistent with their shape and design. Lift and support only from support points indicated on shop drawings.
B. Embedded Lifting or Handling Devices: Capable of supporting units in positions anticipated during manufacture, storage, transportation, and erection.
C. Block and laterally brace units while stored at manufacturers. Provide lateral bracing that is sufficient to prevent bowing and warping that is clean, non-staining, and will not inhibit uniform curing of exposed surfaces.
D. Provide edges of units with adequate protection to prevent staining, chipping, or spalling of concrete.
E. Unless otherwise approved in writing, do not deliver units to job site until required for installation.

PART 2 PRODUCTS

2.1 **CONCRETE**

A. Concrete for Above Ground Structures: Class 5000 minimum per Section 03304 and ACI 318.
B. Concrete for Underground Structures: Class 4000 minimum per Section 03304 and ASTM C 478 or ASTM C 858.

2.2 **ACCESSORIES**

A. Connecting and Supporting Devices: Steel. Refer to ASTM A 36.
B. Bolts, Nuts, and Washers: High-strength steel. Refer to Section 05090.
C. Reinforcement: Grade 60 steel per Section 03200.

2.3 **FABRICATION**

A. Maintain plant records and quality control program during production of structural precast concrete. Make records available to ENGINEER.
B. Use molds which are rigid and constructed of material that will result in uniform finished products.
C. Deposit and vibrate concrete to ensure proper consolidation, elimination of unintentional cold joints, and minimize entrapped air on surface.
D. Fabricate required connecting devices, plates, angles, items fit to steel framing members, bolts and accessories.
E. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are sufficiently embedded, anchored and property located.
F. Ensure finished surfaces of precast structural units are uniform.
G. Cure units under identical conditions to develop specified concrete quality, and minimize appearance blemishes such as nonuniformity, staining or surface cracking.

2.4 **DESIGN DEVIATIONS**

A. Deviation: Provide installation equivalent to basic intent without additional cost to OWNER. Deviations from exact required cross-section will be permitted only with approval.

B. Manufacturer's Proposed Design: Supported by complete design calculations and drawings. When requested, submit design calculations for review bearing seal and signature of Professional Engineer.

2.5 **OPENINGS**

A. Provide required openings, 6-inches or larger. If approved, smaller sizes may be field constructed by coring or sawing.

2.6 **FINISHES**

A. General: The required finish will be described in one of the following paragraphs. If no finish is indicated or selected by ENGINEER; standard.

B. Standard Finish: Produced in forms such as plastic or metal lined that impart a smooth finish to the concrete. Small surface holes, normal form joint marks, minor chips and spall are acceptable if approved. Major or unsightly imperfections, honeycomb or structural defects are not acceptable.

C. Commercial Finish: Produced in forms such as plywood or lumber that impart texture to concrete. Remove fins and large projections and fill large holes. Faces: true and well defined. Correct exposed ragged edges by rubbing or grinding.

D. Architectural Grade A Finish: Produced in forms such as plastic or metal lined that impart smooth finish to concrete. Fill holes over 1/4-inch in diameter with sand-cement paste. Grind smooth form offsets or fins over 1/8-inch. Coat with neat cement paste using float. After paste coat has dried, rub with burlap to remove loose particles.

E. Architectural Grade B Finish: Produced in forms such as plastic or metal lined that impart smooth finish to concrete. Fill holes over 1/4-inch in diameter with sand-cement paste. Grind smooth form offsets or fins over 1/8-inch.

F. Special Finishes: Sandblasting, acid washing, retarders or form liners as approved by ENGINEER. Special finishes require submittal of two 12 x 12-inch samples showing a representative color and texture to be used.

G. Painted Finishes: Use only paint compatible form release agents on concrete that is to be painted.

2.7 **REPAIR**

A. Repair of damaged units is acceptable if structural integrity or appearance is not impaired.

2.8 **ALLOWABLE TOLERANCES**

A. Length: Plus or minus 3/4-inch, or plus or minus 1/8-inch per 10 feet of length, whichever is greater, or as indicated.

B. End Squareness: 1/2-inch maximum.

C. Blockouts: 1 inch of centerline location indicated.

PART 3 EXECUTION

3.1 INSTALLATION

A. Do not install precast units until concrete has attained its design compressive strength.

B. Install members plumb, level, and in alignment within PCI MNL-116 or PCI MNL-117 and indicated limits of erection tolerances.

C. Clean weld marks or other marks, debris, or dirt from exposed surfaces of units.

3.2 PERFORMANCE REQUIREMENTS

A. Conduct inspections, perform testing, and make repairs or replace unsatisfactory precast units as required.

B. Rejection: Units may be rejected for any one of the following:

1. Exceeding specified installation tolerances.
2. Damaged during construction operations.
3. Exposed-to-view surfaces which develops surface deficiencies.
4. Other defects as listed in PCI MNL-116 or PCI MNL-117.

END OF SECTION